Soil Erosion and Water Quality Mitigation in Solomon Islands
A Pilot Project in Honiara and Gizo addressing the problem by building community resilience

1 . SUMMARY

The project is a short term (3 year) pilot program that is planned to demonstrate a wide range of applications for mitigating serious soil erosion and water problems facing residents of Honiara and Gizo and their respective catchment areas in the Solomon Islands using the Vetiver Grass Technology (VGT). Population increases coupled with the impact of climate change are having a devastating effect on the well-being of the residents of these areas who are mainly poor and under supported.

Solomon Islanders heavily rely on their land for their livelihoods. They depend on their environment for food and income from cash crops, for clean water, fertile soil, and forests - for building materials, medicine and for hunting. Compared to other countries, most Islanders have very small 'carbon footprints' having contributed very little to global warming and climate change. Unfortunately they are among those most vulnerable to the impacts of climate change due to their high dependency on their immediate environment and close proximity to the sea. While the challenges ahead are enormous, farmers' innovations can make a great starting point for strengthening food security in Solomon Islands

The project will develop and fund a knowledge based service to communities that would help mitigate both on and off farm problems relating to erosion and polluted water, and in the process build community led resilience to climate change. The project would be executed by two existing non-government organizations, both having some experience with VGT and with community work in the Solomon Islands over the past 15 years. The Vetiver Network International (TVNI) would work closely with both these organizations to achieve project objectives. The project would cost US $131,000. Benefits would include sustainable farm production and food security (without shifting cultivation); improved ground water and related drinking water; reductions in pollution through control of septic tank and landfill effluents; protected and stabilized rural roads; and reduced sediment loads reaching rivers and the sea. In the medium and longer term the experience should be up-scaled to reach the whole of the Solomons, and to other Pacific Islands, and the Caribbean. most of which face similar problems.

2. BACKGROUND

2.1 Introduction. The Solomon Islands (and most other small nation Pacific islands) are facing a possible catastrophic future due to a perfect storm of climate change induced extreme weather events, an expanding, poor and marginalized population, and inadequate social and basic needs services from a limited funded and poor government administration resulting amongst others serious food security and health problems, compounded by degenerating soils, forest and inland and coastal water. One part of the solution is the introduction of low cost and relatively simple technologies that can help build resilient "do it yourself" communities both in rural and urban areas. As part of the process of developing this project proposal Paul Truong (TVNI Technical Director) and Robinson Vanoh (PNG Vetiver Network Coordinator) visited the Solomon Islands in 2015 to review

existing Vetiver applications for stabilizing the steep slopes of the Gizo Correctional Center. It was during this visit that they found that vetiver was already being used to a limited extent for farm/garden fertility improvement by the NGOs KGA and FAITH. It had been used extensively along roads in Honiara for dust control and privacy purposes. However few people knew or understood vetiver's wider applications and its potential impact and value as a "people's" technology for mitigating, at low to minimal cost, many of the environmental issues now facing the Solomon Islanders. This visit was followed, in March 2017, by a TVNI sponsored visit by Robinson Vanoh to: (i) evaluate the existing applications and the effectiveness of VS both in and around the capital city, Honiara, and Gizo island; (ii) identify potential projects to help build community resilience to climate change using the Vetiver System; (iii) and to Identify potential community based organizations that could promote and execute VS applications. His report is at Annex 1.

2.2 The Problem: Accelerating soil erosion and sediment transfer to rivers and coastal waters effecting food production, water quality, coastal fisheries/reefs, and tourism; wastewater, leachates and untreated sewage that negatively impacts on food security, infrastructure, human health, and coastal corals and fisheries; serious health and environmental issues linked to solid waste management in Honiara and Gizo

Reports from Universities and aid agencies refer to the **negative impact** that climate change and increasing population pressure on land and services (where the latter exists) have on current and future island populations. In the Solomon Islands, centres of population such as the capital city, Honiara, are facing serious consequences from: (1) erosion and landslides in the city and surrounding watersheds that result in flooding, sediment deposits on land and in the nearby coastal waters, destruction to property and declining food production. These problems are caused by extreme weather events and misuse of land (deforestation and poor agricultural practices) and lack of mitigating protection measures: and (2) lowering water quality for both drinking and discharge to rivers and the sea, due to unprotected water sources, sediment discharge to water systems, a lack of sanitary services, failing septic systems, and a large proportion of the population with no toilet facilities at all. In parallel to this solid waste management is, at its best, rudimentary resulting in increased health hazards, heavily polluted rivers, drains and beaches. Most reports are strong on policy, but have little to recommend in practical and affordable solutions that can be carried out at minimum cost by a country with limited financial resources and inadequate services. The consequences of not doing anything will lead to a continuing decline in quality of life, increasing health problems, inadequate food security, water induced diseases, and other economic problems. Along with Honiara and Gizo, the rural people and their agricultural lands in all the islands face indiscriminate deforestation causing massive soil erosion and silting of their rivers and streams.

These problems have not been addressed due to lack of policy, funding and suitable technologies. Currently:

(1) Erosion control and slope stabilization, using engineered structures are expensive and inadequate, as such they have rarely been used in the Solomon Islands, and are generally ineffective under extreme tropical weather conditions.
(2) Modern waste treatment systems are costly to develop and operate. In both Honiara and Gizo garbage collection is a problem and the landfills are unmanaged centres for concentrating waste that result in effluent outflows that discharge to river and the marine environment. Neither Honiara (70,000 pop) nor Gizo (6,000

pop) have piped sewage collection; some residents have septic systems with unmanaged effluent discharge, and some have inadequate pit latrines, whilst everyone else uses open public places (often at night).

2.3 The Solution: There is a need for generic, sustainable, efficient, easy to design and install, low cost solutions with wide applicability for and by the poorest, most marginalized and impacted segments of island society. Because of the many different cultural groups in the Solomon Islands any solution that does not depend on government intervention (that is generally ineffective) has to meet the ability of individuals, or small homogenous communities to install and manage themselves on a voluntary basis. A well tested solution that meets these requirements is the **Vetiver System Technology (VST)** that has cross sector applications and could be applied for: **(1) bio-engineering** – for on-farm erosion reduction (from 140 tons soil/ha to 3/tons/ha/ annum), stabilization and reductions in sediment flows associated with road infrastructure and riverbanks, degraded mining and logged areas; and (2) **phytoremediation (VPT)** for improving water quality, treating sewage effluent, and stabilizing landfills and reducing associated leachates.

Vetiver grass (*Chyrsopogon zizanioides L.),* the main component of Vetiver Grass Technology (VGT), was introduced at scale (1980s) for soil and water conservation under World Bank financed Indian agricultural projects. Subsequently, over more than 30 years of practice and scientific research, applications of VGT have been greatly expanded to address numerous other land, water and environmental management concerns in most tropical and semi-tropical countries. In most cases VGT takes the form of dense grass hedgerow filter barriers planted on the contour across the land slope. Historically, the modern uses of vetiver grass started with its application for on farm soil and water conservation; then for road, drainage, riverbank and levee stabilization; and finally for phytoremediation of contaminated soil and water – known as Vetiver Phytoremediation Technology (VPT)

2.4 The Technology: Vetiver grass characteristics

Special soil and water related features (see Annex 2 for examples)

- Dense growth, forming porous barriers that trap coarse and fine sediments
- Reduces soil losses by as much as 90%, spreads out and reduces rainfall runoff (by as much as 70%).
- Reduces drought risks, improves soil fertility, provides for pest management, and increases overall crop income benefits.
- Recharges groundwater.
- Extensive root system that is deep, non-competing, with tensile strength averaging 75 MPa, and soil shear strength improvement by 40%.
- Great longevity and highly resistant to pests, diseases and fire
- Tolerates adverse conditions, including:
  - Extreme climatic variation
  - High acidity, alkalinity, salinity, sodicity and heavy metals
- Thrives under wet and dry land conditions, most soil types and sand
- Demonstrated and recognized as non-invasive.

Special pollution related features (see Annex 3 for details)

Demonstrably efficient in absorption of high levels of nutrients and heavy metals in polluted water and significant reductions (90-95%) in the nitrogen and phosphorous loading of sewage and landfill leachate, near 100% removal of faecal coliforms (from more than 8000/mL to less than 10. **VPT** has low establishment, operating and maintenance costs, is very robust, and has few climatic and geographic limitations.

2.5 Existing applications of VS in the Pacific Islands and Solomon Islands. In the Pacific Islands VGT/VS was first used in Fiji by the Sugar Corporation in the 1950s when VGT was introduced by John C. Greenfield to protect small farm sugar cane grown on steeply sloping lands. Many thousands of hectares of land were successfully protected resulting in significant reduction in erosion and sediment transport and increased cane production (http://www.vetiver.org/Fiji%20Rep.pdf). Unfortunately as farming became mechanised the vetiver hedgerows were removed and serious erosion resulted. More recently in Vanuatu, Don Miller and his colleagues applied VS to a heavily eroded catchment near Port Patrick in order to successfully reduce sediment flows to the nearby reefs and coastal fishery (http://www.vetiver.org/VAN_REEF/VAN-reef2.htm and https://vimeo.com/84261715). Other islands including Guam, Samoa, Papua New Guinea, Tahiti and Hawaii have all used VS successfully for on farm erosion control and slope stabilization. VS has been quite widely used in both the Philippines and Indonesia (western Pacific), both facing similar climate and ecological problems. Most importantly VS has a recent history in the Solomon Islands where it has been very effective for stabilizing slopes (Gizo Correction Center) and roadsides in Honiara (although in this case vetiver was planted for another purpose). It has been introduced to small farmers for mulch as part of a permaculture approach to food production on many of the islands. The largest Palm Oil Company on Guadalcanal uses vetiver for roadside and drain protection. In all cases the plant has grown extremely well and has met the requirements set out in para. 2.4. However because the plant was introduced as a solution for a few specific and isolated problems there is a lack of understanding by the community at large of the broader value of the technology and what it is really capable of achieving. A background report on VGT in the Solomon Islands is at **Annex 1.**

2.6 Institutional development in the Solomon Islands. The economy is dependent on agriculture, forestry, mining, and fishery. Most of the development is in the hands of the private sector, and the government has limitation both in its administrative ability and financial resources. As a result policies are inadequate and poorly regulated. Mining and forest resources are being rapidly depleted and little is done about mitigating related environmental damage. Increasing population pressure is negatively impacting agriculture, and food security is a problem. NGOs have an important role to play and in the agricultural sector. KASTOM GROWERS ASSOCIATION (KGA) based in Honiara, the capital city, has been working with communities and individuals throughout the Solomon Islands to improve food production. FAITH, an offshoot of KGA, operates on Gizo Island. Both groups have introduced vetiver grass as part of their permaculture approach to improving food production. Other agencies include the Honiara City Council, Public Works, Ministry of Infrastructure Development, Gizo Town Authority and Environmental Protection Departments are important potential stakeholders, as is the Guadalcanal Oil Palm Company that has in the past been a supplier of vetiver planting material. KGA and

FAITH, who under the proposed project will be responsible for community related components, have sufficient levels of staffing and community experience to assure successful project implementation. Other NGOs and agencies will be encouraged to participate.

3. THE PROJECT

3.1 The project will support rural and urban communities associated with Honiara and Gizo watersheds to develop programs that will strengthen their ability to meet some of their needs and challenges due to climate change and population growth through community voluntary actions using sustainable low cost biotechnologies based on the unique plant, Vetiver grass, and its applications under the Vetiver System (VS). Activities will focus both on and off farm:

(1) On farm/garden. Most farms are small and are often more like food gardens (both rural and urban). The introduction of vetiver hedgerows will:

- Reduce soil erosion, improve soil fertility and soil organic matter and soil moisture resulting in sustainable and higher crop (coconuts, yams, taro, sweet potatoes, cassava, corn and green vegetables) yields and income. The introduction of vetiver along with better farm practices allows continuous year to year cultivation of the same land as compared to the need for fallowing where vetiver is not used.
- Provide as by-products, mulch, compost (higher soil organic matter), forage, biofuel, and thatch.
- Provide a basis for control of pests - as a habitat for beneficial insects, and as a preferred host plant for the corn stem borer (push-pull effect).
- Provide the opportunity to multiply vetiver plants for sale as a cash business to clients responsible for off-farm applications (see (2) below)
- Demarcate boundaries, act as wind breaks, and privacy hedges.
- Provide a source of material for handicrafts.
- Reduce farm created pollutants (residual agro-chemicals, animal waste) from being transported to downstream streams and waterways.
- Indirectly improve the quality and quantity of local groundwater.
- enhance farmer health with introduction of Vetiver latrine (see: http://www.healthy-mind-body.com/humanitarian/vetiver_latrine.html)

(2) Off farm. Vetiver grass will be introduced for three non-farm application

(a) Infrastructure stabilization. VGT applications will be used to:

- Stabilize and protect roads, bridges and culverts from erosion and washouts.
- Stabilize and protect slopes associated with buildings and houses to prevent and repair hillside slippage.
- Protection of river banks from erosion and in populated areas reduce the movement of effluent and rubbish into drains and rivers.

(b) Pollution control in urban areas. VPT will be used for:

- to stabilize and reduce effluent flows from the two urban landfills in Honiara and Gizo. The proposed treatment strategy will be:
  - *Containment and treat surface runoff from landfill site.* Planting thick hedges of vetiver around the dump as much as much as it is possible and practical. This will provide a physical barrier stopping the spreading of fresh wastes to new areas and also reduce/treat the combination of leachate and runoff from rain.
  - *Treating fresh leachate in the wastes mass of the landfill*. Initially selected sections of the landfill will be compacted and covered with about 1m of soil and planted to Vetiver. With its extraordinary long and penetration root system, vetiver roots will grow right in to the waste mass and dry it up, resulting in reducing the leachate runoff. This operation will reduce the odour and control the spread of pathogens. In addition the landfill site will be covered with green vegetation instead of exposed wastes that attract birds and other vermin. This treatment area will gradually increase according to requirements.
- Reduce, at source, effluent flows from household/industrial septic systems by creating simple constructed vetiver "wetlands" as has been done in urban Lima, Peru and other places.
- Introduction of "Vetiver Latrines" to households who have no toilet facilities, resulting in improved health, strengthened latrine pit walls (vetiver roots), reduced horizontal effluent flow (uptake by vetiver), and improved privacy (vetiver "wall" surrounding latrine). These latrines have proven elsewhere (Halti) to significantly reduce disease.
- Vetiver planting on banks of public drains and rivers to reduce effluent inflows.

(c) Land rehabilitation in associated catchment areas will use VGT and VPT for:

- Mining and quarry rehab with special focus on point source erosion and pollutant control.
- Forestry land rehab, particularly point source locations of heavy sediment flows to the river systems, these may include heavily eroded lands from over logging, and erosion from logging roads, and road related quarry pits.

3.2 The project will be for 3 years with the objective that by the end of the period up-scaling throughout the Solomon Islands will be possible and to other Island nations.

3.3 Operational Plan As with any new technology, there are barriers that have to be overcome in order to effectively introduce the VS. These include: limited expertise, insufficient good quality vetiver plants and difficulty in convincing companies to carry out pilot tests. KASTOM Growers Association (KGA) (Honiara) and FAITH (Gizo) will be the main centres of VS knowledge for the project with regular support from an experienced

VS consultant (Visiting Agent - terms of reference Annex 5) from nearby Papua New Guinea. KGA and FAITH will provide knowledge and training to communities in the respective rural/urban areas and will work closely with other NGOs and agencies that may wish to be involved. The objective will be to encourage the involvement of a wide range of institutions in the execution of the project. Government will be encouraged to create land protection/rehab policies that mining and logging companies would have to follow when receiving operating leases/permits. These policies would include the inclusion of VS into any rehab design (thus helping to establish an expanding market for vetiver growers). A key function of KGA and FAITH will be ensuring the adequate provision of vetiver planting material from their own nurseries and from vetiver growing farmers with surplus plants for sale. It is planned that the promotion of a VS based industry for Honiara and Gizo will be carried out in six (6) phases.

(a) Vetiver Specialist Training Community leaders from KGA (Honiara) and FAITH (Gizo), and key staff from the Honiara City Council, PWD, and other relevant people/agencies would undergo a one week internship on Vetiver System that would be conducted by Robinson Vanoh and Dr. Paul Truong (TVNI Technical Director). Lessons and ideas learned from the training will then be passed on to associated groups/organizations/individuals to implement in the selected pilot project areas. Ongoing training (focussing on quality control, application management, and community effectiveness assessments) will be provided as and when required to assure correct practices during the twice yearly visits by the Visiting Agent (TVNI appointed). Information pamphlets, booklets, posters etc will also be used and distributed to further enhance community and user skills. Training on various VS applications under the supervision of TVNI's Technical Director will be given, ranging from nursery establishment and production, sewage effluent treatment and disposal, landfill leachate treatment and disposal, river and stream bank stabilisation, flash flood erosion control, improved agricultural practices using VS and introducing Vetiver Latrine. These training and support activities are essential for the acquisition by local staff and community users of needed skills and knowledge to effectively address the many aspects involved in the VS implementation. Near the end of each visit by the Visiting Agent a workshop will be held to review and discuss progress.

(b) Identification of initial VS application sites. In collaboration with participating community leaders/users key sites will be identified as demonstration sites at various locations both in Honiara and Gizo that are of major concern to communities. Often these will be point source erosion/effluent sites, or in the case of farms/gardens participants with interest and capability to apply the technology. These sites will be given priority for technology transfer demonstration and will include both on-farm and off-farm applications. It is of importance that these demonstration sites are established in the first year using plant material that is available from the Guadalcanal Palm Oil Company (near Honiara) and from existing farmer/community nurseries .

(c) Establishing two main Vetiver commercial nurseries to distribute vetiver plant material to co-partners and the public sector such as Public Works Department, Honiara City Council, Gizo Town Authority and Ministry of Infrastructure Development. The main objective of these nurseries would be to supply free vetiver tillers to partners in the communities, and to establish a commercial enterprise

component to provide VS application services and vetiver plant material to both government and agro/industrial sectors (including: soil and water conservation in agriculture and forestry; infrastructure protection of roads and highways; mine rehabilitation and phytoremediation; pollution control of industrial wastewater and sewage treatment for small or isolated communities). These commercial nurseries owned by KGA and FAITH would sell vetiver plants at cost and would provide VS technical (consultancy) services at cost to these stakeholders. Funds generated from the enterprises will be used to sustain the ongoing promotion of vetiver system in the Solomon Islands after the completion of the three years project phase. It should be noted that the project will press government agencies to see that VS is incorporated into investment designs and policy where relevant and appropriate.

(d) Growers nursery establishment and production. Interested growers (local communities and small farmers) will be encouraged to establish their own Vetiver producing nurseries. Planting stocks will be delivered free, however they will repay in kind 100% of the project supplied slips after two years to the main nurseries managed by KGA and FAITH. This repayment system will be known as "The Vetiver Bank". Technical support will be provided to these nursery growers.

(e). Community involvement - Intervention/Participation. The interventions will be through extension and community participation. As background, NGOs in other countries have found that VS technologies are easy to share within and between communities. In fact the technologies bring people together for discussion and action - probably because participants can quickly grasp the value and practicality of application. It might indeed be a "community healer".

(i) Extension Approach. Promotion of VS will be based on the following principles of soil and water conservation:

- Soil conservation should follow a bottom up approach: Planned and executed with the full knowledge, cooperation and participation of growers.
- Any proposed practice of soil conservation should offer short term benefits to growers in order to be accepted and would be suitable for the local & climatic conditions to fit the local cropping pattern.
- Soil conservation should encourage the intensification of plant production from land without soil destruction and nutrient loss and in harmony with improved cropping practices following mainly permaculture good management practices.
- Integrate conservation into agricultural practices, harmonize the technical views of experts with that of grower's perceptions and skills
- Most importantly final application and layout should be a compromise between growers' need and the recommended standard design – in other words FLEXIBILITY in design. (one of the advantages of vetiver is in its flexibility of application - as a general axiom bad design will do no harm, good design will be of great benefit).

(ii) Growers Participatory Demonstrations. The adoption of new technology is often slow, because the growers specific needs and/ or limitations are not known

or understood. As a result, the introduced technologies may not be adapted to fit grower's cultural practices. To avoid this, participatory grower soil conservation demonstrations will be carried out on pilot sites. The pilot demonstration will compare traditional practice alongside traditional practice with VS incorporated. In its simplest form it could comprise two plots, each with a plastic lined sediment collection trench that would compare visually the differences in soil and water losses. This intervention will enhance adoption by growers of more suitable conservation practices in the province. It should be noted that KGA/FAITH have already been working with some farmers on using vetiver grass, primarily as a mulch. In such cases it should not be difficult to introduce other VS applications. The current practice of using local family labour on a voluntary basis will be an important part of the Vetiver promotion program.

(f) Vetiver Field Days. Field days will be organized at pilot sites. This will give opportunities to growers to look at and discuss establishment issues, cost, and crop yield improvements and other benefits of Vetiver hedges. Growers will also compare Vetiver technology with other conservation options. Growers "Vetiver" day will be organized at convenient period in each project area. To establish a healthy competitive atmosphere between growers, a participatory monitoring and evaluation of grower's skill and knowledge on VS technology will be carried out. Based on the result of the evaluation best growers will be selected and awarded prizes in the form of money or inputs, so that other growers will be encouraged to participate.

(g) Project Report, Evaluation and Recommendation Seminar. At the end of each year a one day seminar will be organized with key stakeholders and government agencies to review and discuss progress and issues. Based on these reviews modifications would be made in the program. At the end of the project an end evaluation would be undertaken in cooperation with TVNI

3.4 Implementation responsibilities. KGA/FAITH will be responsible for community/individual related activities including those associated with farm/garden practices, community/individual effluent reduction, and vetiver latrine introduction. KGA/FAITH will collaborate with City and Municipal staff and others, including private sector enterprises in promoting and providing information/training and plant material for landfill improvement, road/drain stabilization, forestry and mine land rehabilitation. Funding for implementing such components will not be a project responsibility and are not included as part of project costs. The role of the Visiting Agent will be critical to the success of the project. The VA will: (1) the VA will provide practical experience (2) train critical staff and stake holders (3) assess quality of applications (4) support KGA and FAITH in discussion with other both government and private agencies/companies that may participate in the project, and (5) provide an independent conduit to TVNI and other funders

4.0 PROJECT COSTS

The three year cost of the project is estimated at US$ 131,000 as itemised below:

No.	Expenditure Categories	Amount US$	Additional Comments
1	Vetiver slips for planting in agreed pilot location & Community nurseries.	10,000	Mobilization fund to purchase vetiver slips from existing growers, especially in Honiara where there is no main nursery and to set up the main nurseries both in Gizo and Honiara to cater for increased capacity. Will also be setting up mini nurseries in respective communities where projects will be implemented.
2	Visit by Visiting Agent to the Project sites (Travel expenses – 2 trips/year @$2,300/trip. and fees $2,000 per year	19,800	Travel, accommodation expenses, and fees for Visiting Agent to travel to Honiara and Gizo twice a year for site visit and to evaluate the progress of the funded project. These trips will also include trainings for leaders.
3	Coordinate Stakeholders in the project sites and review of suitable Pilot project areas	6,000	Funds to mobilize team leaders in respective CBOs to enable them to coordinate stakeholders at project sites. Includes transportation costs and allowances.
4	Community surveys to determine project sites, Present livelihoods and aspirations inputting data and analysis	3,000	One off cost for community surveys to determine project sites, present livelihoods. Support for collection of input data and surveys in outer Island provinces to expand the promotion and awareness for widespread us of VS.
4	Field visit to successful Vetiver-based pilot project sites and selected stakeholder trainees to include “Vetiver Field Day”	8,000	Travel expenses, allowances for community leaders to visit sites and identify sites for best demonstration/practises. Also inclusive of awards for participants and Field Day Expenses.
6	Contribution to the local community groups for awareness with the theme “building community resilience to climate change using the Vetiver System”.	8,000	support funds to community groups with proven and approved programs. Funds to help accelerate VS uptake and demonstration
7	Equipment, supplies and documentation: Computer work, Equipment rental, stationeries, etc.	6,000	To support training, promotion and dissemination
8	Project management monitoring and evaluations by TVNI	6,000	Visit by TVNI Technical Director during and before completion of project phase to monitor and evaluate the success of the project. Includes travel to sites for visit.
9	Administration	3,000	KGA and FAITH office admin costs
10	Wages	36,000	7 full time staff for KGA and FAITH
11	Transportation	3,000	Local movement of staff (bus, etc)
123	TVNI Service and audit fee	10,000	administration of funds, report reviews, and final audit of project
	10% for contingencies	11,900	
	Total Project Cost	**130,700**	Rounded to **USD 131,000**

4.1 Detailed annual costs are shown in Annex 7. In a pilot project like this estimated expenditures have to be flexible as some components are likely to move faster than others. The project team will prepare six monthly budgets based on field experience and

demand by communities. These budgets and plans will be reviewed and agreed by TVNI prior to the next release of funds.

4.2 Project funding. Where project funds are raised through TVNI sources those funds will be held by TVNI, and transferred (see 4.1) to FAITH and KGA under agreement. KGA and FAITH are registered charities. TVNI fund transfers will only be made against satisfactory six monthly reports and budget agreement. Funds flows raised directly by KGA/FAITH will follow individual donor requirenments

5. Evaluation and Monitoring. The project will keep records of its activities and will record and monitor development of project components. Photographs and user feedback will be an important part of the monitoring effort, as will be simple input and output data on application costs and benefits. Where possible project sites with vetiver applications will be located on Google Earth. The monitoring results will be used to create an end of project evaluation that can be used as a case study and basis for future up-scaling within the Solomon Islands and other Island nations.

6. BENEFITS

Farm/garden related benefits In line with experience elsewhere in the wet tropics crop/garden yields are expected to increase by 30% with the introduction of VGT. As most farms are on slopes greater than 20% vetiver hedgerows will significantly reduce erosion and improve soil moisture. Because of its deep root system and large biomass vetiver recycles soil nutrients and improves soil structure and its microflora and fauna. Soil organic matter improves with the use of vetiver leaves for mulching. An average 1 ha farm would need about 1000 linear meters of vetiver hedgerow – about 8,000 vetiver slips – to be totally protected. Other farm related benefits would include vetiver leaf use for forage, thatch, mulch, chicken and pig litter, and occasionally for fuel. Some farmers could sell vetiver plant material for off farm purposes. Leaves are an excellent resource for handicrafts if the demand and skills materialize. Other on-farm social benefits would include farm boundary demarcation, privacy hedges, homestead site stabilization, clean-up of polluted wastewater, and a key component for vetiver latrines and the related improvement of disease control. These same vetiver hedges would have important off-farm benefits including reduced sediment flows to downstream water systems, slowdown of rain water discharge at the time of heavy rainfall events, improved groundwater resulting in better spring flows, reliable and better quality well water, and improved dry season river flows.

Off-farm application benefits

(1) Infrastructure stabilization VGT expected to be used by Public Works Department, Forestry Department, and others for stabilizing the cut and fill slopes of rural roads. Rural roads are a major point source of erosion and sediment flows to streams and rivers. With increasing extreme weather conditions there are frequent washouts of bridges and culverts that are costly and disruptive to communications. VGT planting of approaches to these structures will reduce flood damage and associated repair and maintenance costs. As rural roads are the main arteries of rural communities, providing access to markets and other services, their protection is

vital for the well being of rural communities. VS road protection using VS will save significant annual maintenance costs.

(2) Pollution control VPT when used for landfill treatment, septic systems, drains, selected river banks, and improved pit latrines, will reduce effluent flows to waterways and eventually the sea, and will improve groundwater quality. VPT is within the reach of even the poorest households and communities. It can be easily scaled from micro to large-scale applications and in many cases be deployed by non-specialists, requiring little external inputs beyond knowledge and Vetiver. Community health is expected to improve. According to WHO/UNICEF's 2010 Joint Monitoring Program untreated sewage results, worldwide, in an estimated 750,000 childhood deaths annually, most of which occur amongst the rural poor. If contaminated water was not treated, the spread of water-borne pathogens such as bacteria, fungus and algae is a major health issue for these rural communities.

(3) Land rehabilitation - Mining and logging operations are major sources of sediment flows to downstream areas and the sea. Sediment from mine operations is further contaminated by the associated heavy metals. VGT will significantly reduce sediment movement and provides the companies involved with these operations a low cost remedial technology.

(4) Coastal waters and coral reefs. Reductions of sediments and polluted effluents through VGT applications will, as shown in Vanuatu, benefit sea wildlife habitat and associated fishing and tourist industry

(5) Human health The population of Honiara and Gizo will benefit from food and less disease through VPT and VGT applications. Costs of health care should decrease and food production will be more secure.

(6) Carbon sequestering Due to its high biomass and massive roots system vetiver is recognized as a significant sequester of atmospheric carbon.

Wider benefits from future up-scaling. Although the main focus of the project is in the catchment areas of Honiara and Gizo municipalities the project will promote and influence the use of VS in other SI islands and hopefully in other Pacific Island and Caribbean nations. If successful it can be expected that other governments and NGOs will take up the technology to mitigate the worsening impact of climate change on their populations and economies. There are alternative technologies, but most are costly, complex, and often unattractive to the end user. Introducing them can be slow and narrowly focused. VS is one of the few technologies currently available that can be easily introduced and widely up-scaled. At this critical time of climate change rates of application is essential and makes the VS an attractive technology for a number of sectors.

Investment benefits. VS applications are proven and simple to design and install. Capital investment costs are less than 10% of traditional methods and the recurrent maintenance costs are minimal. A World Bank Study by Yudelman, Greenfield and Magrath (1990) indicated a 95% internal rate of return when VGT was used for on farm erosion control, see: http://www.vetiver.org/USA_Yudelman_Greenfield_Magrath_1990.pdf

In recent years small farmers have started seeing vetiver as a cash crop and are making handsome income from selling plants to other farmers and to contractors for infrastructure and pollution related projects. This business approach could be greatly

expanded if local policies demanded the use of VS when applicable. Given Vetiver's extreme longevity, VS is a sustainable investment.

ANNEX 1. Report on Visit To Solomon Islands March 2017

The Vetiver Network International
Proven & green environmental solutions

Promoting the Application and Acceptability of

Vetiver System Technology and its applications in the Solomon Islands; and identifying potential projects to help build community resilience to climate change using the Vetiver System

FIELD TRIP REPORT

INTRODUCTION

Representing The Vetiver Network International (TVNI), I visited the Solomon Islands from 27th March 2017 through to the 31st March to identify and establish contacts with interested NGO stakeholders who would agree to identify, prepare and manage a "project" that would meet TVNI objectives as detailed below in the report. TVNI made it possible with a travel grant of USD2300.00 to cover travel and accommodation costs for the trip.

The purpose of the my trip was to assist The Vetiver Network International in identification of a pathway for a rapid expansion in the promotion and adaption of Vetiver System to benefit initially communities in both Honiara and Gizo Island, Solomon Islands. With the objective of increasing rural and urban communities build resilience to climate change and in particular, through Vetiver System applications. It will also provide the means, at low cost, for effective, Soil and Water Conservation, Pollution control that would improve food production and security and health and at the same time reduce sediment flows and pollutants to coastal inshore waters that is having an impact on its marine life in the coastal and island villages.

CONTACTS OF INTERESTED AND COMMITTED STAKEHOLDERS WHO ARE PREPARED TO PROMOTE VS IN SOLOMON ISLANDS.

Following are two key stakeholders in Honiara and Gizo respectively who have willingly showed interest in promoting VS in the Solomon Islands. Some other community based NGO's were identified, however due to time factor I was not able to meet them to discuss further.

1. Faith Garden Programme (FGP) – Gizo

FGP is a legitimate home-grown Community Based Organisation (CBO) and registered by law and that works with rural communities to promote sustainable household and national food security and soil management. It has 3 fulltime staff who run the organisation. The word "Faith" means "Food Always in the Homes". This rural development initiatives was borne in 2010 by interested and active local farmers who wish to work together to organize, encourage and assist its members to play and take an active part in all activities related to agricultural development in the province.

FGP currently provides practical demonstration training to farmers. It also facilitates practical work experience for Agricultural students from the rural training centres in the Solomon Islands and sharing of planting materials and information to farmers in the province. The group was also involved with funded projects by World Fish in Gizo with an annual expenditure of SBD200, 000. Some other smaller projects under SBD100 000 were also successfully managed by FGP in Gizo and the outer Islands of the Western Province.

2. Kastom Gaden Association (KGA) – Honiara

Kastom Gaden Association (KGA) was established as a charitable trust in 2000. It grew out of a five-year programme of an Australian NGO focused on providing services to

the subsistence and local market agriculture sector which encompassed the clear majority of the rural population. At the time this sector was poorly serviced and poorly recognised by government, donors, and private sector.

The KGA mission is to 'STRENGTHEN VILLAGE-BASED FOOD SECURITY IN THE SOLOMON ISLANDS USING PARTICIPATORY, PRACTICAL, GRASS-ROOTS APPROACHES THAT ENABLE VILLAGE PEOPLE TO EXAMINE, UNDERSTAND, AND DEVELOP THEIR OWN SOLUTIONS TO IMPROVING HOUSEHOLD FOOD SECURITY AND VILLAGE- BASED AGRICULTURE ECONOMY'.

Stakeholder	Contact Person(s)	Contact Number	Contact Address	Location
Kastom Gaden (NGO)	Clement Hadosia	(677) 7495544	clementh27317fh@gmail.com	Honiara
Faith Garden Incorporated (NGO)	John Holland Mathew Ganuru	(677) 8908339 7740078	matgarunu@gmail.com	Gizo
Honiara City Council (GOVT)	Eddie Gaza	(677) 27545	worksmanager.hcc@gmail.com	Honiara

HOW, WHEN AND WHO ORIGINALLY INTRODUCED VETIVER GRASS INTO THE SOLOMON ISLANDS

Establishing facts on how, who and when the Vetiver Grass was first introduced into the Solomon Islands remains a mystery untold as no one seems to know. Various interviews I conducted to residents and respective authorities also are unsure. One resident who resides at the Panatina ridge said planting was done by women who were engaged by the City Council, he said they were told the grass was to keep rats out of their residences and keep dust out from the roads. That's all they knew about Vetiver, until I took out the Vetiver poster and had a session with them explaining, then only they knew the uses of Vetiver Grass. Some residents were very excited and asked how to do planting and said they will with immediate effect plant them on their slopes to control erosion.

The Ministry of Infrastructure Development engineer Evelyn and Honiara City Council personnel were also interviewed and little did they know about the grass as well. They said they would obtain further details and get back to me. This also gave me the opportunity to introduce the VS to them and its importance. Expression of interest to promote the system looks positive, over time I will be keeping in contact with them to have the system rolled out. City Council Manager, Eddie Gaza expressed their willingness to work together with any NGO that will be engaged to promote the system. The Honiara City Council have shown keen interest in implementing the VS so they will be our target authority to mitigate most problems in the capital city at cost.

John Holland of Faith Garden in Gizo got their Vetiver slips from an open Agricultural Day that was hosted by the Agriculture Ministry in Gizo. It was brought in from Simbo

Island where it was introduced there for erosion control on slope gardening. John Holland said he saw the vetiver grass left lying on the ground after the field day and out of curiosity and with interest he took it to his house and started multiplying it. Initially he used Vetiver for mulch only until 2015 when Dr Paul Truong and I pointed out to him its other uses during our visit to his farm to source plant supply for the Correctional Centre project.

In Honiara, vetiver was introduced to KGA by Tony Jansen (KGA founder) and Roselyn Kabu. They picked the planting materials from Fore Agriculture College in Malaita province in 1996 and brought it to KGA to be planted and used as part of its training for different farming systems introduced by KGA. Tony who used to work in South America, knew about the importance and uses of the grass, thus when they saw it at Fore, they decide to bring it to KGA. It was after this that the grass was spread across the country through KGAs Planting Material Network (PMN) members/ farmers.

EFFECTIVENESS OF EXISTING VETIVER NETWORKS

The effectiveness of existing vetiver applications and its impacts were visually and anecdotally observed during my visit and included but not limited to on Gizo and Honiara respectively:

1. GIZO CORRECTIONAL CENTRE SLOPE STABILIZED WITH VETIVER GRASS

A site trip was taken around the proposed project sites by Mr. John Holland Seti (FAITH Garden Program Trust Incorporated) and myself. We started with site inspection of the Gizo Correctional Centre Slope Remediation project. The new center funded by AusAid was not able to be used due to a major Slope Failure in 2014. The following pictures show the slope before and five months after VS implementation.

Extensive erosion and land slips on unprotected slope causing severe damage to buildings prompted authority to adopt Vetiver System Technology.

However, this has since opened and now in use after the remand center was stabilized using the VS. The whole perimeter of the remand center is now planted up with more than 50,000 Vetiver tillers by FAITH Garden as shown in pictures 1 – 10.





Pictures 1 – 6: Random shots of the Vetiver planting in the remand center from different locations.


Pictures 7 & 8: Virtually silt free drains demonstrate effectiveness of Vetiver in reducing erosion


Picture 9 & 10: John Holland (left) who supervised the planting and Robinson Vanoh (right) who coordinated the Slope Remediation project.

The impact of the VS was very significant as evident in minimal erosion in the Vetiver planted areas. The drains hardly contained any silt as visually observed during the visit. The hedges also acted as very good wind breakers for the sea breeze.

A few residents were interviewed about sighting of any pests or snakes due to the area being covered up with Vetiver grass. No sightings of such were reported, similar observation is observed in PNG. A few trimmings of the hedges here and there by respective house occupants were noted. It would be ideal to have a uniformity in trimming and upkeep by the prisoners as a training. Whilst there during my last visit, training was conducted to the prison officers who will then pass on the knowledge to prisoners who can then be used for the upkeep of the centre and can also be used in some public plantings as and when required so the knowledge they learn can be taken back to their communities.

Erosion reduction on roadside plantings done on the Panatina Ridges were very encouraging though. The plantings are signatures of someone who knew the Vetiver System well. It is highly likely KGA founder, Tony Jansen may have introduced

vetiver grass to the city council who may have done the plantings, which needs further investigation and confirmation. The plantings were scattered and isolated in most areas, it is highly likely planting was done as a hedgerow to stabilize road batter, however some may have been uprooted and or destroyed unknowing by residents.

The plantings seem to have been planted some 15 – 20 years ago, as some residents who I interviewed knew little or none about the Vetiver Grass planting. On slopes where vetiver was planted, slopes were fully stabilized, and unlike where they were not planted, erosion and landslips were evident.

Panatina is a neglected part of the city boundaries where it lacks the basic government services such as water and sanitation despite been highly populated. Some residents are made to walk for distances to collect drinking water, use nearby bushes and creeks for toilets and so forth. Hence, Solid wastes are either burned or dumped in small streams posing a lot of environmental risks downstream for the marine life. It is also the main feeder to the Lunga Watershed management area. This part of the area is hilly and all the residential houses are built on hills posing immediate danger to landslip. Massive soil erosion was noted which is a continuous danger if no sustainable practices are initiated for these areas.




Pictures 11 – 14: Vetiver planting on cut batters to protect slopes on residential properties.






Pictures 15– 20: Random shots from the Panatina ridge planting at different locations for hillside road stabilization.

Image 1: The route taken to visually observe impacts and also establish facts on the establishment of Vetiver Grass on the roadside & hills. Pictures shown

above are all from this road. Other plantings were also seen on other adjacent hills as well.

OTHER SIGNIFICANT IMPACTS IN SOLOMON ISLAND FOLLOWING INTRODUCTION OF
OTHER SIGNIFICANT IMPACTS IN SOLOMON ISLAND FOLLOWING INTRODUCTION OF VS
AT GIZO CORRECTIONAL CENTER IN 2015

The impact of the VS was very significant as evident in minimal erosion in the areas planted up with Vetiver grass on the very steep and highly erodible site, with no erosion on the slope and the drains hardly contained any silt as visually observed during the visit.

A few residents were interviewed about sighting of any pests or snake's due to the area being covered up with Vetiver grass. No sightings of such were reported.

GIZO ISLAND - Mountain Home Made Safer and Greener with Vetiver Grass (Jah Hill - Gizo)

Some residential properties were also inspected where vetiver was introduced after the success of the Centre by John Holland also showed very positive results. One such residence was that of Mr. Bob McFarlane, a retired volunteer who had worked in a couple of Pacific Island nations and is from New Zealand. He spoke highly of the vetiver grass when I spoke to him. The grass was the answer to his problem as stated. In some areas, the planting was not done correctly, however this was corrected.


Picture 21 & 22: Vetiver planted in front of drains which were dug initially to reduce velocity of water to control soil erosion on hill top.


Picture 23 & 24: Planted across slope contour to stop soil erosion and proven to be a success.


Picture 25 & 26: Bob McFarlane (left) and John Holland, on the right is Mr McFarlane's residence on hill top.


Pictures 27 & 28: View from the top, note the number of drains dug which was only a short term solution which was dug prior to the vetiver introduced to him.

On Farm Applications (Faith Garden organic vegetable demo farm)

Faith Garden Programme (FGP) is a home grown community based organisation (CBO) that works with rural communities to promote sustainable food security and conversation. Following pictures shows demo plots where FGP uses to train its rural farmers on best sustainable farming practices.

John Holland and his family manage a demonstration farm on the outskirts of Gizo for this purpose. He has trained many vocational students, but with limited funding from the Government. Finance has been Faith Garden's main constraint in implementing its programs effectively.


Picture 29 – 33: Faith Garden Organic Vegetable Demonstration farm.

John has been cultivating on this portion of land over the last 6 years with his sustainable practices of soil moisture retention and soil fertility practice using vetiver leaves as mulch. ***His neighbours however had to leave their land for fallow whilst he is continuously farming on his model farm***.

Image 2: The route walked on Gizo to visually observe impacts and also establish facts on the establishment of Vetiver Grass on the Correctional Centre Slope failure and other residences. Visual observation of problem areas were also observed on the hills.

The geology of the site comprises volcanic breccia (typical tropical volcanic Red Earth), which has been weathered to residual soil, completely weathered and highly weathered material. The patterns and colours of the parent breccia rock are still evident but the strength is completely changed to a firm fissured silty CLAY, the fissures being coated in a layer of soft clay. Establishing of good agricultural/permacultural practices between hedgerows will be very important to improve soil fertility and hence its productivity.

GUADALCANAL (Honiara Capital City)

Infrastructure Protection in Oil Palm Plantations (GPPOL)

The only oil palm company in the Solomon Islands also has vetiver planted on its plantation to stabilize drain walls, culvert headwalls and its roads. When the Plantation, Manager (Mesach Boge) was interviewed, he spoke highly of the Vetiver Grass. He said its impacts on the roads, drains and culverts were very significant as seen. He also has an established nursery at his house where he distributes tillers to workers to plant. He was one of the main suppliers of the tillers for the Gizo Slope Remediation project where he supplied more than 30,000 tillers.

Pictures 34 & 35: Plantation road stabilization, also planted to stop debris from being washed onto the
roads during flooding.


Pictures 36 & 37: Culvert headwalls stabilization (combination of gabion basket with Vetiver grass)


Pictures 38 & 39: Meshach's nursery which has the capacity to supply more than 50,000 planting slips

CONFIRM THE READINESS OF PARTICIPANTS TO PARTICIPATE

The communities on Gizo are keen and are ready to participate, actually they have and are starting to use the vetiver grass applications in some of their residences. Some have also requested Faith Garden to install vetiver on their properties where land is slipping. John Holland has been promoting its use to some local residence on Gizo, however due to lack of funding, he was only able to do little.

There are about seven (7) co-partners and they are as follows: Gizo Community Farmers Group, Rural Training Centres Solomon Islands, Bibolo Community, Vorivori Community, Saeraghi Community, Koqulavata Community and Gizo SDA Community. They are community based groups in and around Gizo who are prepared and ready to promote and even use the system. With the success story of the Correctional Centre slope remediation project, the system is highly likely to be accepted by the community with ease and great interest.

Clement Hadosaia from Kastom Gaden was actually very excited during our discussion in promoting the system. He already was picturing possible sites that the initial pilot projects will be carried out as part of the awareness program.

KGA currently has no donor funding or new project, therefore, its staff were laid off in December 2016. Ideally, they can link up through the umbrella NGO body "Development Service's Exchange". The Development Services Exchange (DSE) is the country's national NGO umbrella body. It is not a requirement for NGOs to register as a charitable organisation with the Solomon Islands government, but this can prove beneficial to credibility and property ownership. It is the body that administers and monitors all other NGO's within the country. Otherwise, Clement is currently organizing himself to create a new registered group, which is currently under discussion. They may also try and link with KGA, but the fact is that the organization is run by the Board and decisions takes longer to be made. His group consist of all former KGA staff, and therefore they have the necessary experience and knowledge to carry out the work/ activities for the proposed project.

Currently KGA have scaled down its operations and only a skeleton staff are maintaining their office, hence their ability to take the lead is very remote, it may take time for them to regroup to take the lead. However, Clement Hadosaia has shown interest and is willing to take the leading role for Honiara. He has already regrouped his team who were laid off by KGA to take the lead in Honiara as advised recently after my trip. He has been advised to team up with a legally registered CBO to take on the leading role. KGA has 22 staff in a structure that was developed with input from partners, farmers, staff and board members with the aim of providing the best services to rural people. The staff numbers have, however been reduced, and currently only a skeleton staff is managing KGA operations due to lack of donor funding. See: (http://kastomgaden.org/about/team/) for background details of their staffing structure and their board members.

John Holland and his Faith team in Gizo are all set to take responsibility as the lead agency in Gizo to take up the project. With their recent experience in the planting of the slope failure remediation project, they are all set to go.

All in all, it is recommended, as agreed with Clement and John, that we have 2 lead agencies for the project, one for Honiara and the other for Gizo Island. KGA operations are guided and run by a board, hence delivery of services as and when required can be affected as experienced in their previous funded projects.

AGREEMENT ON THE BROAD SCOPE OF PRIMARY VETIVER ACTIVITIES (APPLICATIONS)

GIZO

The broad scope of activities that will be undertaken in Gizo by FAITH Garden as discussed and agreed with John Holland and his project coordinator, but not limited to include:

1 Water Conservation

The Island population entirely depended on rain water for consumption. The only water supply in town is a small reservoir which supplies the business community. Whilst the local communities in the settlements depend on small stream catchments, however not safe. Water conservation and retention is of a major concern.

With its rapid growth many of Gizo's hillsides have been settled without approval, as there were few other options for available land. This has caused problems for water catchment that serves the township's water supply. Following are programs that can be done to help solve these problems:

1- Erosion and sedimentation control to protect creek bed from silting up.
2- Planting along stream bank edges to improve water quality.
3- Soil erosion control on hillside by contour hedges to improve water conservation (like Ethiopia) resulting in more stream flow.

Picture 40: Standby water reservoir catchment for settlers

Picture 41: Rain water

2. Soil Conservation/ Erosion Control and Slope Stabilization

Gizo Island's topography is relatively low. Flat land at 50 cm above sea level only covers a narrow strip averaging at 25 meters from the low water mark to the edge of the foothills. The inland ridges are irregular with intruding valleys and foothills but are gentle and more rounded therefore it is vulnerable to soil erosion as evident.

Runoff and catchments among the foothills form a number of streams discharging at various sites causing soil erosion on most residential properties as seen.

From aerial photos streams discharging into the sea with significant silt "fans" will be identified and implemented with priority. In addition planting on all dirt road batters would also be a priority (most roads on the island are dirt roads). Communities residing along these roads will be encouraged to plant.

Picture 42 & 45: Slope failures like this are common sites for the township which poses immediate danger. Two houses were buried by this slip in January. Slope stabilization of these sites will serve multipurpose objectives - land slip protection, garden erosion control, soil fertility improvement.

3 VS for Agriculture

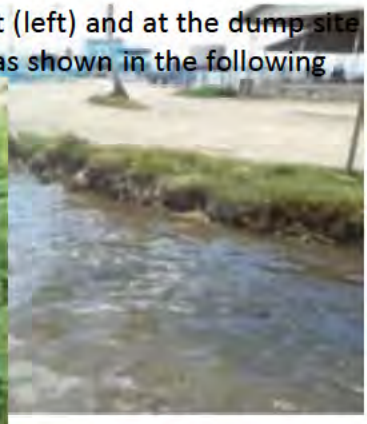
Agriculture in Gizo consists of two subsectors: subsistence garden farming, averaging 0.3 - 0.5ha and commercial farming, averaging 1-2ha. The predominantly Gizo community engage in subsistence agricultural activities which are often combined with cash cropping. The main root crops are: cassava, sweet potato, yams and taro. Root crops and vegetables are part of the staple diet and supplement income gained from sale of cash crops such as cocoa and copra. It is basically a "garden" farm economy.


Picture 46 & 47: Gizo market where all their cash crop are sold to supplement income. Note the abundance of root crop & Vegetables.

4. Solid Waste Management (Landfill)

Solid Waste management of the island is of a major concern as evident. The only landfill they have is located 400 yards from the sea on the edge of watershed management area which poses risk of highly toxic waste leaching into the ocean. Solid Waste from the township is dumped on this site and is not managed as shown in following pictures below. Initially a Vetiver planted buffer zone around the perimeter of the land fill – particularly on the down side - would reduce escaping garbage and help reduce leachate flows. If the garbage is piled up better Vetiver can be planted into it – as was demonstrated in Morocco and China on a small village scale. Town authority will be approached to fund the project to be implemented by FAITH.


Pictures 48 & 49: Uncollected rubbish at the main market (left) and at the dump site (right). This rubbish when dumped ends up in the ocean as shown in the following pictures below.



Pictures 50 & 53: Polluted water at sea fronts near the main market and shopping centre.

5. Sanitation (Vetiver Latrine)

Lack of proper sanitation is among Gizo's number one health issue. Most of the houses seen seem to have no proper sanitation, if there were any, the toilets were not even safe for use as they were only walled with plastics as privacy shields.

One of the biggest issues faced by the local people is on proper sanitation. People residing in the lagoon are using the mangroves and shorelines as toilet ground. The currents circulating within lagoons are holding on to these waste matters, if these people continue using these sites as toilet grounds, their health is at stake because the lagoon offers their fishing ground.

Vetiver latrine will provide a Vetiver screen for privacy, pollution control, and pit stabilization, cement and rebar for constructing moveable slab – see: http://www.healthy-mind-body.com/humanitarian/vetiver_latrine.html

Gizo cultural approach (population 6,154+)

All in all, the concept to be used in promoting the use of Vetiver System will be family based concept and unlike in their previous programs where they used community based projects where it has failed due to lack of leadership and team

work. Lack of funding has being another major obstacle in driving projects forward. With the Solomon Islanders being such a diverse nation, the language and cultural barrier between each tribe poses a serious threat to any community based projects, therefore, family based concept will be adapted on Gizo as discussed and agreed with the Faith team. Sub-communities will be involved in our discussions/meetings, however implementation will be carried out by few families living together as this concept is working well for the communities in Gizo. Communities at large will then be involved during the phase of the project in for the community based projects.

HONIARA CAPITAL CITY (Population 70,000)

The Solomon Islands capital Honiara, as a developing city, has one of the highest urbanisation rates in the region, and the basic service infrastructure is struggling to cater for the influx of people from the provinces to the capital, Honiara. As such some key projects as discussed and agreed upon, and also identified to be undertaken by Kastom Gaden (Clement Hadosaia) in Honiara includes:

Solid Waste Management (Landfill)

The Ranadi landfill site managed by the Honiara City Council is also of a major concern to the community. Dumping of solid waste at this landfill is uncontrolled and open as shown in picture 41 and 42. Solid waste there are uncovered, opening burning of rubbish heavily pollutes the air. With serious leachate discharge of leachate to a major drain to the sea. Initially a Vetiver planted buffer zone around the perimeter of the land fill – particularly on the down side - would reduce escaping garbage and help reduce leachate flows. If the garbage is piled up better Vetiver can be planted into it – as was demonstrated in Morocco and China on a small village scale. City Council will be approached to fund the project to be implemented FAITH and Custom Garden.

Also observed on the Panatina Ridge settlement areas, residences burn their waste, dispose of it in their backyards, and in the river or streams. These is evident from the volume of waste seen on the beaches along the shoreline. Improper waste management contributes to environmental pollution and the clogging of waterways, creating conditions that can be further exacerbated by climate change impacts. The shorelines of the city is also noted to be heavily polluted with waste dumped into the streams or the rivers as shown in pictures 56 and 57. (see Indonesia Citarum River: http://www.vetiver.org/INR_Citarum River Basin.pdf

Picture 54 & 55: The Ranadi Landfill Site with uncontrolled dumping of rubbish (Photos courtesy of Clement Hadosaia).

Picture 56 & 57: Waste washed down from upstream on the shorelines of the city near Pacific Casino.

Sanitation and Vetiver Latrine

Very few people have access to flush toilets as am been told, some use pit toilets and almost more than half the population use the sea, river or nearby land. The state of sanitation is equally critical. Most people use the nearby beach, even though it is not safe to use at night," stated by one resident who was interviewed.

One family when interviewed said they only have excess to a pit toilet, however they cannot use the toilet during the day because it's an open pit toilet. She said they cannot use it because other families sit around during the day and therefore there is no privacy, Toilet outfalls into open drainage, bathing and kitchen grey water runs directly into open drainage canals. Also noted were waste from pig pens also run

directly into the open drainage which is a major concern. Introduction of Vetiver latrine to the communities will be an ideal project and will therefore be accepted by all concerned communities with much interest. Honiara City Council contracts out the emptying of septic tanks. It is recognized that most septic tanks overflow and pollute the drainage systems. The planting of Vetiver at the septic tank outlet would reduce this discharge to the drains, reduce small and improve health – this activity requires maybe 50 vetiver plants/septic tank and could be done by homeowners. Vetiver latrines also very important for those who do not have septic tanks. Vetiver planted as buffers along streams and drains will help reduce waste discharge to water bodies.

Picture 58 & 59: Drainage canal (left) serving as toilet outfall and connecting into a larger creek which flows to the main rivers and eventually into the sea.

Soil Erosion Control & Conservation

Soil erosion in and around Honiara is of a major concern as evident all over. Uncontrolled logging and deforestation that was done some years back upstream had left the land vulnerable to soil erosion. Due to pressure in population growth, most of the hilly areas are farmed and the soil exposed to sheet erosion. Deforestation is one of the significant environmental problems in Honiara. The related problem of soil erosion is a threat to the country's agricultural productivity if nothing is done to control soil erosion.
Soil and water conservation, and sediment control with VST are proposed for both agriculture and logging. Land owner groups to approach logging Co. to fund the planting cost with plants supplied at cost by KGA.

Picture 60 & 61: Unsustainable farming practices on the hillsides as seen on the Panatina ridges

Picture 62 & 64: Uncontrolled logging upstream on the top right resulting in rivers being heavily silt with deposits.

Watershed Management

The capital city Honiara is sitting on a time bomb if no immediate environmentally sustainable protection systems such as the vetiver system are implemented. The three main rivers (Lunnga, Mataniko and White river) that run into Honiara have heavy deposits of silt from upstream exposing the city prone to flooding. Therefore the initiative of promoting the use of vetiver system is timely and will by all means will be an impact project for the cities watershed management area.

The Lungga River is on the city boundary of Honiara, has periodic flooding problems, has encroaching urban sprawl, hydroelectric power options and is an important local asset for recreation, and small business such as the local car washing industry with in-stream use. The upper catchments are forested, with lower clearings being pasture land with limited animal grazing and village food production, this terrain is interspersed with some deeply incised rugged gorges. These would be ideal catchment area for the watershed management project.

Bottom up approach is proposed and these will be implemented at the later stages of the project implementation.

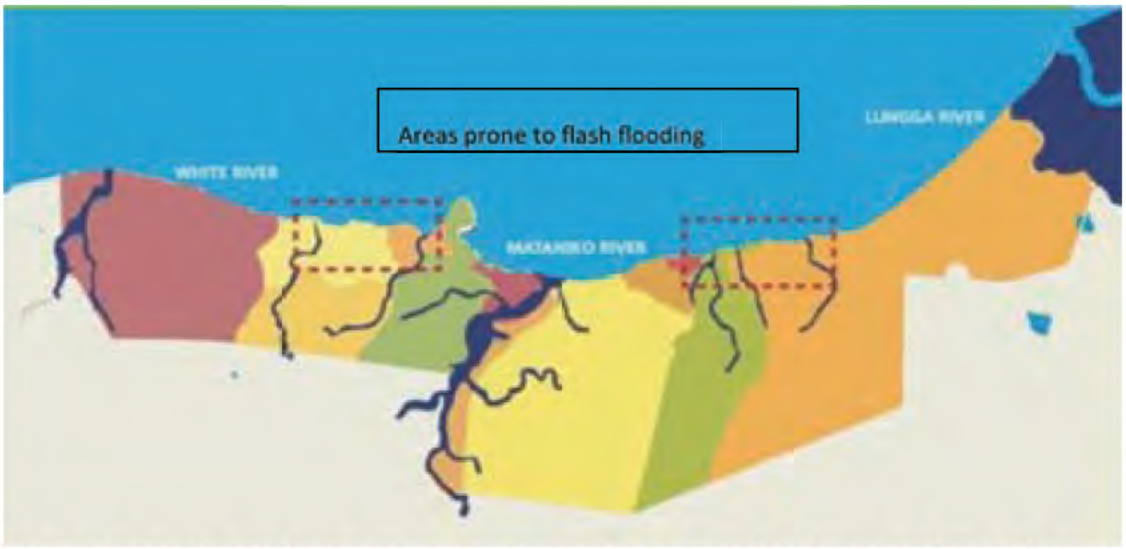


Image 3: Location of three main rivers and areas exposed to Riverine Floods. (Source: UN-Habitat National
Geographic Information Centre, SI)

Picture 65 – 68: Catchment areas of main rivers with heavy deposits of silts on river banks

Water Conservation

Most households I spoke to in Honiara experience shortages of clean water for cooking, drinking and washing on a daily basis. Most people as observed do not seem to have any water supply to their homes, it is highly likely they collect water from wells, rivers and streams.

Much of the water supply and sanitation infrastructure in Honiara was seriously damaged during the
'Tensions' and, since then, development funding has prioritised peace and reconciliation, law and justice, governance and economic development therefore this remains a major concern for the city as reported.
VS will play an important role in the absence of basic services such as lack of water and sanitation. Vetiver latrine, small stream protection from pollution, and erosion control are some practices that can be introduced to residents in lieu or in the absence of these service to promote a healthy living.

Agriculture

Residents who lived along the Lungga River that were affected by the recent flash floods in Honiara in
2015 were moved to higher grounds further up the catchment area as shown in pictures below. Their only means of survival is farming, therefore farming upstream is their main activity, hence is also one of the contributing factors for soil erosion.

As agreed with Clement Hadosaia, piloting a major project (Agriculture package) where they were resettled would have a lot of impacts on people's livelihood and the environment as a whole. Agricultural uses of Vetiver including soil and water conservation will be promoted (under tropical conditions VS will reduce erosion from as much as 140 tons to 3 tons/ha/annum, soil fertility enhancement – improved organic matter, mulching, animal forage, bedding for pigs, compost, habitat for beneficial parasitic insects, garden/farm boundary delineation, home stabilization, thatch, and fuel).


Picture 69 & 70: Re-settlement areas for those that were affected by the flood in 2015. Farming on hillsides as this aerial pictures is a common practice

Infrastructure stabilization

Infrastructures in Honiara are of a concern if no sustainable practices such as the Vetiver System are not introduced as observed. Recent flash floods have in recent years completely washed out bridges and houses affecting the business community. Honiara remains under threat of further destruction.

While driving out of Honiara on the East side highway towards the oil palm plantations, I noted that almost 60% of the bridges is about to be washed off should there be another flash flood. Soil along bridge abutments are heavily washed out and exposed to further damage if no immediate preventative measure is taken to stabilize walls. Honiara City Council and the Ministry of Infrastructure Development are highly likely to be involved in any Vetiver based project. MID was involved in the inspection of the Gizo correctional centre project so they are fully aware of the VS. I had a word with the Works Manager (HCC) and the lead engineer (MID) whilst in Honiara during my visit.


Picture 71 & 72: Pictures of destruction to business houses and bridge infrastructure by the recent flash floods (Pictures courtesy of John Holland).


Picture 73 & 74: New Nbalishuma bridge under construction after it was destroyed by flash floods recently (left) and an existing bridge which is also under treat of being washed out if the abutments are not protected.

POTENTIAL COMMUNITIES THAT ARE LIKELY TO PARTICIPATE IN THE PROPOSED PROJECTS BOTH IN GIZO AND HONIARA

Following potential communities from both Gizo and Honiara were identified to participate in the proposed project to be initiated. Other communities are likely to follow suit based on the outcome of the initial communities.

Gizo	Honiara
Gizo Community Farmers Group	Honiara City Council
Nusa Mahiri Farmers Network Group	Lungga Flash Flood victim re-settlers
Rural Training Centres Solomon Islands	Panatina Settlement communities
Bibolo Community	Honiara Community Farmers Group
Gizo SDA Community	Panatina Catchment Community
Correctional Centre Prisoners	Ministry of Infrastructure Development (MID)
Gizo Town Authority and Other NGOs	Coral Triangle and Other NGO's or donor agencies

SOME KEY COMPONENTS AND POLICES TO BE FOILLOWED

To implement the project in line with TVNI requirements, KGA and FAITH have drafted the seven following policies:

1. Be financially responsible and acquit all funds to the donor as and when required.
2. KGA and FAITH to submit a completion report on completion of the project.
3. Serve as a lead extension centres to supply vetiver tillers to other interested users and government agencies.

4. All plantings to be done by respective communities, landowners and the PWD where concerned and affected. We will supply the tillers free to communities and landowners as part of our promotion, which will then be repaid to the Vetiver bank after a year. It will be sold at cost to the City Council and the MID to generate additional income to sustain the operations of the project.

5. Functioning as lead organisations for providing knowledge and training of vetiver applications among the affected local communities, as well as the public and private agencies.

6. Launching campaigns among the local communities encouraging them to acquire the knowledge on vetiver ecotypes, maintenance and benefits, and to extend the results to other neighbouring communities so that they can adopt the knowledge gained on their own land at home in their respective provinces.

7. Continue to promote and carry out awareness on the use of vetiver system after the completion of the project phase.

COMMUNITY RESPONSIBILITIES

Responsibilities are an individual's duties or obligations to the community and include cooperation, respect and participation. The concept goes beyond thinking and acting as individuals to common beliefs about shared interests and life. Communities in both Honiara and Gizo must be able to take the leading role and ownership of the project as and when implemented for the betterment of their environment. Their responsibilities are listed herewith but not limited to:

(1) Make land available for the establishment of primary nurseries for tiller distribution.
(2) Be able to provide labour at cost or on voluntary basis to see the success of these very vital projects sustainability.
(3) Be socially responsible toward environmental issues. Striving for social responsibility will help the community have a positive impact on the use of VS, with positive contribution to bottom-line results. **The roles of KGA and FAITH in promoting adaptability and acceptability of Vetiver System will be, but not limited to:**

- Provide ongoing progress report for the project during the duration of the project.
- Yearly Acquittal of all funds and report back to the donor agency.
- Set up a committee for the project of promotion on planting Vetiver with Community participation and hold meetings among the committee.
- Set guidelines and regulations including assessment and evaluative procedures.
- Produce young vetiver grass for distribution. Ensure responsible groups produce young vetiver grass within the project site areas.
- Propagate vetiver grass by distributing it to targeted communities.
- Local employment are provided in the targeted areas for producing and caring for young vetiver grass.
- Build informative signboards at each project site stating the project's name, responsible unit, and funding-provider.
- When young vetiver grass becomes strong distribute them to respective communities as most communities cannot afford vehicles and transportation costs for vetiver grass transportation.
- Promote and support information about vetiver grass for communities.
- Distribute educational and promotional material about vetiver grass to use as documents for the trainings and distribute them to local communities. The materials are in the form of books, pamphlets, posters, and videos.
- Train to ensure knowledge of vetiver grass in the course of developing and promoting the utilization of vetiver to conserve soil and water with community participation.
- Provide knowledge about vetiver grass utilization for soil and water conservation.
- Promote by providing knowledge and create understanding to make sure that the locals see benefits of vetiver grass according to the saying, "Plant vetiver grass in people's mind first, then in the areas." This is because the

benefits of vetiver grass will not show in a short period of time. At the same time, awareness will also rise, encouraging communities to promote the utilization of vetiver grass in neighbouring communities and encourage participation among local people

- Build awareness and motivation by having local activities related to vetiver grass on important days such as the “Vetiver Field Day”.
- Build vetiver grass networks among private organizations, local communities, and youths by having them participate in the program so that they will be the next generation leaders to promote the benefits of vetiver grass, hence encouraging and persuading neighbour communities to plant vetiver grass in their own fields.

TRAINING

The adoption of new technology is often limited, because community specific needs and/ or limitations. are not well understood. As a result, the introduced technologies may not be adapted to fit communities' cultural practices. To avoid this, grower's participatory soil conservation demonstration will be carried out on pilot demonstration sites. The grower's participatory pilot demonstration activity will comprise two or more of existing (structural) soil conservation practices and Vetiver hedgerows as a new technology. This intervention will enhance adoption by growers of more suitable conservation practices in the project sites.

Since the promotion of Vetiver System Technology to be undertaken is going to be new in the Solomon Islands, KGA and FAITH extension workers, who will be involved in the program will be trained by TVNI on Vetiver System Technology. In turn, the extension workers will train, advice and guide growers and users to facilitate the adaption of Vetiver System Technology.

Field days will also be organized to discuss with growers and users in pilot sites. This will give access to growers to look and discuss about best demonstrated practices, how best to promote the system cost effectively, in terms of labour. Growers will also be able to compare Vetiver technology with other conservation options. Additionally, this will give opportunity to demonstrate the additional benefits that could be driven from Vetiver. Growers "Vetiver" day will also be organized at convenient period in each project area to ignite and motivate the wide spread use of Vetiver. This will be an opportunity for others to see and learn how best others are using the system.

Community leaders and NGOs from other parts of Solomon Islands will also be invited for our trainings in Vetiver System technology so that they can take back to their communities VS information in order to start their own programs.

PROMOTION

To establish a healthy competition atmosphere for growers and users, a participatory monitoring and evaluation of grower's skill and knowledge on VST will be carried out by TVNI technical team randomly during the duration of the project phase.

Based on the result of the evaluation best growers will be selected & awarded in the form of money or in puts, so that other growers will be encouraged. To assess how effective the extension is being used to promote the adaption of VST, regular monitoring & evaluation will be carried out. Awarding of recipients will be done during the Vetiver Field Day.

Since it is essential to evaluate the efficiency of Vetiver planted in the pilot project years. A case study of Vetiver as a tool for application and acceptability of Vetiver Grass Technology and Vetiver System applications in the Solomon Islands will be undertaken.

The current practice of using local family labour on a voluntary basis will be the major input into the Vetiver promotion program.

A main community nursery where Vetiver promotion program is going to be implemented will be established both on Gizo and in Honiara. The capacity of the main nursery and production capacity will be increased to meet demand. Thus, supply of a health and adequate amount of planting stock, on time, will be guaranteed from the established nurseries.

Interested growers will be encouraged to establish their own Vetiver producing nurseries. Planting stocks will be delivered freely from the main nursery. Technical support will also be given to them. "A Vetiver plant bank" will be considered. For every Vetiver slip provided at no cost to a user, that same user will return 2 slips after two years – these can come from a growers own nursery or from splitting a hedge. This is a good way to expand Vetiver supply as the demand increases.

EXPECTED PROJECT RESULTS

Expected results of the three year project duration both on the Island of Gizo and in Honiara are:

- Establish a main stock nursery with holding capacity of more than 40,000 per month to be distributed to all communities involved in the promotion of VST. Refer table (market opportunities) on projected estimates that is expected out from the nursery and also estimated returns which can be able to sustain its operations after completion of the project.
- To have clean water for home use, VS will play an important role in the absence of basic services such as lack of water and sanitation. Vetiver latrine, small stream protection from pollution, and erosion control are some practices that can be introduced to residents in lieu or in the absence of these service to promote a healthy living.
- Control and reduce landslides in the project areas.
- Stop or minimize soil erosion in all affected areas.
- Improved agricultural soil fertility, improved permaculture practices (mulching etc), and improved yields
- Solid Waste on both landfills are managed to protect our environment from further pollution.
- Introduce Vetiver Latrine to at least more than 60% of the pit toilet users.
- Introduce Vetiver for septic tank effluent discharge control.
- Train non project community leaders and NGOs in VS.
- The community to fully accept the adaptability of Vetiver System for Climate Change resilience by end of project completion.
- A healthy community
- Vetiver System that is fully accepted and its adaptability to combat climate change resilience fully adopted.

MARKET OPPORTUNITIES

There are also market opportunities for vetiver in the Solomon Islands, which when propagated in the main nursery can be sold to the PWD, City Council, MID or any other interested stakeholders. Estimated aggregate demand and potential estimated financial returns are. Increase in propagation by 30%/year.

Year	Slips to Propagate	Distribution (60%)	Sales (40%)	Lineal Meter to install	Revenue (at SBD5.00/slip
1	480 000	288 000	192 000	96 000	960 000.00
2	624 000	374 400	249 600	124 800	1,872,000.00
3	811 200	486 720	324 480	162,240	2,433,600.00
4	1,054,560	632 736	421 824	210 912	3,163,680.00
5	1,370,928	822 557	548 371	274 186	4,112,785.00

KEY ISSUES THAT MIGHT AFFECT PROJECT BEING IMPLEMENTED

Some key issues that might effect the project being implemented includes but not limited to:

- One of the main constraint of the association will be the lack of adequate facilities and equipment to assist in delivering the necessary needs and services to members and farmers in the community. With adequate funding, these will minimise the main constraint as VS does not require high tech facilities and equipment.
- Cultural barriers
- Lack of understanding of the new Technology being implemented.
- Unavailability of basic services such as transportation to deliver and carry out promotion and awareness. However, local paid transportations are available which can be utilised to distribute to respective sites and also to the outer Islands.
- Discussion can be dominated or side tracked by a few individuals.
- The information may not represent the whole community, which may require additional focus groups.
- Lack of Stakeholder Engagement – A disinterested team member can destroy a project

COSTS ESTIMATE

Since accurate cost breakdown requires a detailed feasibility study of total area selected for the Vetiver promotion program, a lump-sum money of **USD119, 600** is estimated for the project on Gizo Island and Honiara respectively. Total cost can be proportioned as 60% for Honiara and 40% for Gizo. However this amount can be either reduced or increased based on funding eligibility and progress.

EXPENDITURE CATEGORIES	TOTAL
1 **Vetiver slips for planting in agreed pilot location and Community nurseries**	10,000
2 **Specialists:**	
Visit by TVNI rep to the Project sites (travel expenses - 2 visits/year @ $2300/year	13,800
b. Consultation/allowances fee for the Consulting firm @$2000/year	6,000
c. Coordinate Stakeholders in the project sites and review of suitable Pilot project areas	6 ,000
3 Community surveys to determine project sites, Present livelihoods and aspirations etc:	
Inputting data and analysis	3,000
4 Training, workshops, seminars and awareness programs	
Field visit to successful Vetiver-based pilot project sites and selected stakeholder trainees to include "Vetiver Field Day".	8,000
Contribution to the local community groups for awareness with the theme "building community resilience to climate change using the Vetiver System".	8,000
5 Equipment, supplies and documentation: Computer work, Equipment rental, stationeries, etc	6,000
6. Project management monitoring and evaluations by TVNI	6,000
7. Administration	3 ,000
8. Transportation	3,000
9. Wages	36,000
Sub-total	**108,800**
10% for contingencies	**10,800**
TOTAL	**119,600**

POTENTIAL SPONSORS

Potential International agencies such as JICA, AUSAID, USAID, NZAID, KOREAN AID, TAIWANESE, GERMAN GTZ, DANISH, and DUTCH ETC can be sought to sponsor the projects to be initiated in the Solomon Islands.

Other potential sponsors can be from the Palm Oil Company, Logging companies and even from the
Fisheries Industry.

ACTIVITY	IMPLEMENTATION TIME						RESPONSIBILITY
	Apr	May	Jun	July	AUG – OCT	Nov	
Report write-up							Robinson Vanoh
Report Review One							Robinson/Faith/KGA
Report Review Two							R. Grimshaw/P. Truong
Final Review							R. Grimshaw/P. Truong
Agreement on project components/details							FAITH,KGA, TVNI
Project Proposal - Final							R. Grimshaw/P. Truong. Vanoh
Project Funding							R. Grimshaw
Start Project							Robinson/Faith/KGA

CONCLUSIONS

The Solomon Islands possess valuable natural resources that should be protected because they are vanishing at an appalling rate. Beautiful lagoons, rushing rivers and lush rainforests cover the islands, and contribute to the illusion of a tropical paradise.

The pathway for a rapid expansion in the promotion and adaption of Vetiver System to benefit initially communities in both Honiara and Gizo Island, Solomon Islands is one such project that must be accepted by both the government and the community. With the objective of increasing rural and urban communities build resilience to climate change and in particular, through Vetiver System applications is highly recommended.

It will also provide the means, at low cost, for effective, Soil and Water Conservation, Pollution control that would improve food production and security and health and at the same time reduce sediment flows and pollutants to coastal inshore waters that is having an impact on its marine life in the coastal and island villages.

The majority of the urban and semi-urban population in Honiara and the Island communities on the Island of Gizo remain unaware of the pressing problems occurring in their respective communities. Without the creation of a stable health and educational infrastructure, the Solomon Islanders cannot deal with the onslaught of social-economic problems.

The only way to improve the conditions of the communities involves the full cooperation of the government in protecting the environment and providing adequate information to ensure the survival of the people.

Unfortunately, the government still needs to get their heads out of the clouds, and plant their feet firmly on the ground to protect their environment from further destruction. Government must be able to fund and work closely with community based organisations (CBO) as a way forward. The government does not have the capacity and its inability to effectively manage its resources is a major setback for environmental protection initiatives

RESPONSE BY ROBINSON VANOH TO TVNI COMMENTS ON REPORT

1. I believe that we can end up with a good project. I have noted some comments, observations and questions in the report. Here are some more.
We are also of the same believe, hope we can get this project through and start the project towards the end of 2017.

2. I think that the two project areas and their core components can be technically undertaken with good results.
I am also of the same opinion, it may be slow initially during the commencement stages, however as it picks up momentum, we can get very good results from these core components

3. The project should be flexible so that when one component is slow or unpopular resources can be shifted to a popular component.
Yes, I would agree with you, I am pretty sure some components which are popular will be very fast, therefore our flexibility in this regard will give ample opportunity for rapid expansion for the popular components.

4. KGA and FAITH priority should be to:
a) Identify/mobilize communities and organizations, For example Honiara City Council, Lions /Rotary Clubs and others, University?, Church groups, neighbourhood/community groups, forestry, mining companies.
b) Train and provide knowledge
c) Provide initial plant material
d) Monitor progress and
e) Source additional funding from donors through awareness presentations.
John Holland from Faith in Gizo and Clement Hadosaia from KGA in Honiara are already in the process of identifying and mobilizing CBO's, however will get in touch with them to identify some educational institutions, church groups, women's groups and other interested groups within and also from the outer Islands as well. Island provinces such as Malaita, Makira, and the Western Province are already using Vetiver so that would be easy to promote its other uses as well to them apart from soil erosion control which they are familiar with. Faith have a main nursery where they multiply there stock and distribute to their farmers in the outer Islands, they only need to increase the capacity of the nursery to cater for demand. The team in Honiara will need to establish a main nursery, apart from Mesach in the Palm Oil Company who has his own where he cultivates to plant out in the oil palm plantations. He can be approached to supply us some tillers for our initial stock. It is our aim to increase the capacity of the main nurseries both in Gizo and Honiara where all the planting stocks for the projects will be supplied from. Hence these main nurseries can also be able to supply to business houses on a commercial basis to generate income to sustain the project after its completion phase.

5. After the first year (assuming an initial 3 year program) involve out of project leaders from other provinces in awareness presentation and training. This should speed up longer term scaling up.
It will a 3 year program, hence after the first year of the program we will surely roll out the

program to outer Islands through awareness presentations and trainings. During the first year, I will do a lot of training to respective leaders of communities that will be engaged in Gizo and Honiara respectively and equip them with as much information as possible. I would appreciate if TVNI can be able to send me some posters, pamphlets and books to distribute during our first year.

6. It is important to identify and agree on a formally organized organization (KGA?) to manage the overall project (with external support from Robinson). This organization will receive the funds from the donors.
At this stage Clement is liaising with some legally registered organizations which we will work with to implement our project. Having worked with KGA, there has been some setbacks seen at KGA which will likely hinder us from implementing our program in a timely manner and effectively. I have tasked Clement to identify and get back to me ASAP.

7. We need some detail as to how some of the VS applications will be applied. Soil and Water conservation and slope stabilization is fairly straight forward. The three areas I would like to hear more about are: landfill proposal, improved water supply applications, and complimentary agricultural improvements on farm/gardens (how do farmers get hold of improved fruit tree plants, etc?, and who is responsible for helping them? Is this part of FAITH and KGA responsibilities?

Landfill Proposal
I did a proposal on Solid Waste Management here in PNG and have submitted to the city authority who manages the wastes and am still waiting on their feedback, I have also emailed Clement a copy of the same proposal to use in Honiara. I advised him to approach JICA and the City Council for funding support to manage their solid waste. I will also email you a copy of the proposal. We will basically use the same principle on the landfills. It will be a service we will provide and they pay us for our services by respective city councils to generate additional income to sustain our operations.
Improved Water Supply Applications Fresh water scarcity is a threat to human health, food supply, poverty, and gender inequality in both these areas. Residents both on the Panatina ridge and those on Gizo Island who are of the poorest entirely depend on stream water from the springs for fresh drinking and cooking water. However these very same streams are heavily polluted with waste from residents which is of a great concern to human health. The local population will suffer severe fresh water shortages if nil to no water conservation practices are practised.

Application of the Vetiver System for wastewater treatment is highly recommended because it is a natural, green, simple, practicable and cost effective solution and most importantly, its by-product offers a range of uses from handicrafts, animal feeds, thatches, mulch and fuel just to name a few which local residents can use to substantiate for additional income. Vetiver will be planted along streams to absorb effluent and grey water runoff from toilets and kitchens, which is running into small streams which feeds into the main river and runs down the slopes into the sea. It will be planted to:

- · Trap Debris, Sediment and Particles which will run into the stream.
- · Absorbing and Tolerating Pollutants from human activities.
- · Planted around springs to treat water and also for water conservation.

Complimentary Agricultural Improvements on farms/gardens

Solomon Islanders depend on their land for food, income and the survival of present and future generations. Their sandy and constantly eroding mountain land is slowly losing its productivity which supports little more than cassava, their staple diet. The country lacks economic development and therefore unemployment rate is very high. Thousands graduating from the higher institutions are forced back into the communities therefore introducing VS will have an impact in their lives. Also communities that were displaced and affected by the recent flash floods living in settlements will be our target community groups to carry out our awareness and promoting the use of VS. I would suggest we use the same strategy used in Bali involving the improvised communities by David Booth - VETIVER IMPROVING LIVES OF IMPOVERISHED INDONESIAN SUBSISTENCE FARMING MOUNTAIN COMMUNITIES, LED BY CHILDREN. I Read through and it's very encouraging to see how VS has improved a lot of people's lives. I believe this same concept will work in the Solomon Islands.

8. Note I understand that most of the poorest of the communities could take advantage of the Vetiver Latrine package, but those better off in the community may have septic systems(I can guarantee that all of them are discharging effluent. It would be very easy to reduce this using VS, and it might be a good way of initially getting these urban folks involved on an individual or neighbourhood basis.

You will note I mentioned in my report as Panatina being abandoned populated area, basically because this part of the ridge lacks the basic infrastructure services provided by the government. Most of the water and sanitation infrastructure were destroyed during the ethnic tension, therefore Vetiver Latrine package will be an advantage to the community at large. Everyone is discharging effluent therefore getting the urban folks to be involved is highly likely instead of targeting the poorest of the community only. Most homes on this part of the ridge is privately owned, therefore it will draw a lot of interest when introduced to them.

9. Most of the reports (JICA, AUS-AID, ADB) that I have looked at write favourably about using VS for erosion control in the Solomon Islands. You should remind these agencies about that and encourage them to participate – even just a few thousand dollars in the beginning, (many of the donor country representatives have a slush fund for such purposes.

I agree with you to this regard, this will also be one of our main task to do whilst promoting the use of VS, we will actually team up and knock on some doors of donor agencies based in the Solomon's. I am pretty sure as we promote and carry out awareness, it will draw attention of these donor agencies.

10. We should try and get the Oil Palm Company involved as a plant supplier partner and may be a provider of transport occasionally.

I personally know the General Manager and the Plantation Manager with the oil palm company so that is to our advantage. I will negotiate with them if they can be involved in supplying us some vetiver slips initially whilst waiting for our nurseries to mature. It will also be part of their responsibilities towards their stakeholders in terms of environment protection and community participation in environmental protection.

ANNEX 2. The Vetiver System supports Community Resilience – Farm application

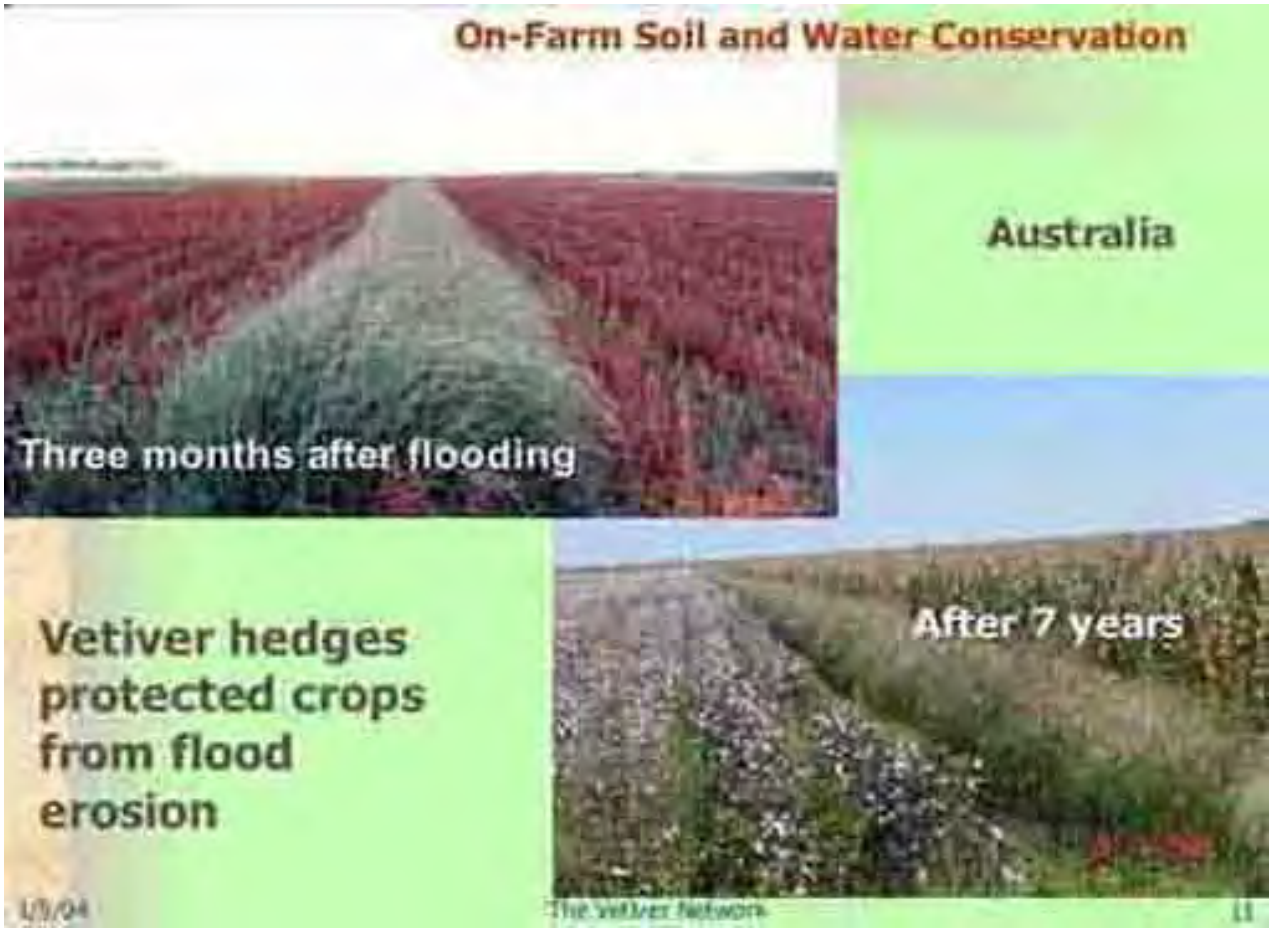
I propose to write about how the Vetiver System can help build up community resilience in these uncertain times when many communities can expect little support from government or others to deal with increasing problems created by climate change, continuing poverty, and very limited financial resources. The review will be carried out over a number of post. Most rural people in the tropics and semi-arid areas are poor, and even when out of poverty most are unable to manage the environmental crises that currently, and in the future, will confront them. Most communities worry about being able to make a decent living from their small farms or businesses, they want to educate their children at higher levels, they worry about the quality and availability of their water supply, they worry about potential disasters that may isolate them from neighbouring communities and services, and they see continuing and unabated health challenges often caused by environmental mismanagement. These concerns are magnified because most communities lack access to low cost technologies that might help them overcome some of their problems.

The Vetiver System (VS) is one of a number of technologies that can help them. VS is low cost, relatively simple to understand, safe, and has over the past 30 years been well proven. The Vetiver Grass Technology, (VGT) used for decades by farmers in south India as a tool for soil conservation, was reintroduced and "institutionalized" by John Greenfield of New Zealand whilst he was working for the World Bank in India in the 1980s. At that time the objective was to establish VGT as a more appropriate erosion control technology than the traditional engineered contour bunds. Later VGT formed the basis of a number of other applications that collectively are known as the Vetiver System (VS), these will be reviewed in future blogs. The grass when planted as a hedgerow across the slope significantly reduces soil loss and rainfall runoff. As a result soil fertility is enhanced (increased organic matter, reduced nutrient loss, and nutrient enhancement through increased soil micro-organism activity), crop water availability is improved (enhanced permeability and rate of infiltration), ground water is better recharged is less polluted, and; and farmers can use other crop improvement technologies with less fear of "man" induced drought, flood damage, etc. that can lead to economic disaster. Additionally there are many bi-products that further enhance farm income including vetiver grass use as forage, mulch, thatch, fuel, medicine, crop protection (integrated pest management), and material for handicrafts. All these uses are quantified in the many research and "feedback" papers and documents found at the TVNI website - www.vetiver.org.

MADAGASCAR

Madagascar is typical of most tropical countries where rainfall is high and erosion is a major problem. In addition Madagascar is subject to frequent cyclones that create huge slips on unprotected slopes. In this instance the landslides not only negatively effected the rural poor but also created severe economic loss to a whole sub-region because of damage to the railway line. Through an ingenious system of "crop - vetiver modules", good community involvement and education, and a properly funded and managed program), the results were impressive. Soil erosion and land slippage was halted, farmer income improved substantially and the recommissioned railroad continued to operate even under the harshest climatic conditions. Vetiver System technology was the "glue" that enabled the program to work. It stopped the land slides, prevented erosion and improved crop productivity (both annual and perennial tree crops). The farmers were delighted and started spreading the technology to adjacent farmers

AUSTRALIA



Erosion problems occur not only on steep slopes, but also on fairly flat land (<1%) as well. The black cotton soils of the Darling Downs of Queensland, Australia are subject to occasional flooding that causes major erosion problems. As a result a method of strip cropping has been devised that takes about 33% of the land out of cultivation. Under Australia's Land Care Program farmers planted vetiver hedgerows across the slope. Erosion was effectively minimized, flood damage became insignificant and the hedgerows stayed where they were planted - even after 7 years as shown on the image to the bottom right. Note the good crop of cotton and maize on either side of the vetiver hedgerow. Better still more than 90% of the land can be cultivated, and excess fertilizers and agrochemicals are trapped by the vetiver hedgerows

INDONESIA

The East Bali Poverty Project (KB106) was planned and managed by an NGO - the Ekoturin Foundation. It is located in the mountainous area of Bali, it is dry and the soils are eroding rapidly. The communities in the area are the poorest of the poor, illiterate, undernourished, and most adults suffered from goiter. The project provides education to children and improvements to agriculture through educating the children. The Vetiver System is the enabling "glue" that has been used to stabilize the improved roads and to conserve the steep hillsides. As a result the farmers are now able to grow decent crops of potatoes for subsistence and for sale; incomes and nutrition are improving all through children being taught about vetiver, improved farm methods and better nutrition.

more at:

https://drive.google.com/drive/folders/0B3E8MMCy36wZYmIwMzgwYmQtYzgyOC00NDc3LTgwMTctYzYwNWJlZDRhNmJk?hl=en

CHINA

The Dabie Mountains is host to some of China's poorest people. This mountainous area in Anhui Province is heavily eroded and the soils are each year becoming more infertile. The China Vetiver Network, the Salvation Army, and local governments programmed and funded a project (KB347) to provide improved services and technologies to farmers in a pilot area. The project was based on many years of investigation, scientific trials and on the local social and economic situation, local government and farmers warmly welcomed it. The project used Vetiver System as a key component for erosion control. At the same time emphasis was put on economic tree production and water conservation so that farmers could better their profits. Currently the China Vetiver Network is seeking additional benefits for farmers through vetiver handcraft making, by providing vetiver pruning or crude process materials to the handcraft factories that have close cooperation with export agencies.

VIETNAM

Farmers in Central Coastal Vietnam are regularly confronted with flood or storm related damage, and have to spend much of their time and money to restore badly damaged structures. The measures they have used include stabilization of dykes by local grass, which are easily uprooted by flood, or small waves, hence are not effective, or short-term measures such as blocking sand dune flow by sand dykes, which themselves are poorly stabilized due to lack of vegetation cover. Technical support, when available, has its own problems. Local civil engineers are used to more expensive hard solutions such as rocks and cement, even these solutions are not always effective or durable. Agro-forestry projects focus on tree planting but it is expensive to implement and slow in growth. Trees are effective for wind erosion control but they give little protection against neither water erosion nor trapping sand eroded by heavy rainfall. With a small grant from the Netherlands Embassy, a vetiver trial and demonstration project was initiated in 2001 (KB812). The results were outstanding and both local farmers and engineers now adopted VS as their preferred option for sand dune and road batter stabilization, stream bank erosion control and fishpond stabilization

THAILAND

Cassava (*Manihot esculenta* Crantz) is the third most important food crop in southeast Asia. Most farmers realize, that cassava production on slopes can cause severe erosion, while production without fertilizers will lead to a gradual decline in soil productivity. Research has shown that cassava yields can be maintained for many years with adequate application of fertilizers and/or manures, and that there are various ways to reduce erosion. In order to enhance the adoption of soil conserving practices and improve the sustainability of cassava production under a wide range of socio-economic and bio-physical conditions, a farmer participatory research (FPR) approach was used to develop not only the best soil conservation practices, but also to test new cassava varieties, fertilization practices and cropping systems that tend to produce greater short-term benefits. The farmer participatory approach to technology development and farmer-to-farmer extension has been further developed and the total number of sites has rapidly expanded to about 32 sites in Thailand, 35 in Vietnam and 23 in southern China (KB63).In Thailand, farmers in almost all sites selected the planting of contour hedgerows of vetiver grass as the most effective and most suitable practice to control erosion. In 2002 nearly 900 farmers in 18 sites in eight provinces in Thailand had planted a total of 130 km of vetiver grass hedgerows in close to 950 ha of cassava fields. Through the use of a farmer participatory extension approach, including cross visits, farmers' field days, training courses and the establishing of community-based self-help groups, the number of farmers planting vetiver grass is growing day by day. In the long-

term, this will result in less erosion and the conservation of soil and water resources to the benefit of farmers as well as the community as a whole.

More at:

https://drive.google.com/drive/folders/0B3E8MMCy36wZYmIwMzgwYmQtYzgyOC00NDc3LTgwMTctYzYwNWJlZDRhNmJk?hl=en

ETHIOPIA

One of the most successful and widespread on farm application of vetiver has been in the Mettu-Gore region of western Ethiopia, where it was introduced in the 1990's by the Austrian NGO, Menschen fur Menschen, with some financial support from TVNI. Today tens of thousands of small farmers are using vetiver in that region. Here are some examples from Ethiopia showing how VGT has been successfully used on farms at any scale.

Hassan Ali and family, a small farmer in Gore District, started using vetiver about 20 years ago to improve soil fertility and "rainfall security". As a result he was able, year after year, to increase his income enabling him to educate his children through university. He also was a key person in the area to teaching other famers about the benefits of VGT that has resulted in the spread of the technology. "Seeing is Believing"- Figure 2 is a 2014 Google Earth image of his farm with his vetiver hedgerows marked with a "V" in red, and some photos that I took in 2009 to match some of the locations on the GE image - marked as yellow numbers.

	Figure 1: Hassan Ali and family from Ethiopia - a leading user of the Vetiver System and who as a result is much more resilient to uncertainty
	Figure 2: Google Earth image (1/2014) of Hassan Ali's farm near Gore - western Ethiopia. 8°11'11.23"N, 35°21'2.58"E

	Figure 3: Earlier this land had a crop of maize, upper row of vetiver cut for forage
	Figure 4: Well grown vetiver hedgerow. Although this hedgerow looks wide in fact when cut as in figure 5 it takes up very little of the farmer's land. The biomass from a hedge like this is very high (100 tons /ha equivalent) when properly managed
	Figure 5: This hedge has been cut for forage. It should be noted in this image how the vetiver grows up the terrace riser as sediment is deposited

	Figure 6: Vetiver hedgerows functioning well and no hindrance to ploughing.
	Figure 7: Even though not a complete hedge, these clumps and their roots hold the slope in place, and spreads out rainfall runoff
	Figure 8: An excellent example of a cross section of one of Hassan Ali's hedgerows. Note the difference in height between the two boys caused by terrace build up as a result of the hedgerow

These images 3-8 show vetiver hedgerows in various state of management and uses - vetiver cut for forage, lower row, mature vetiver to be cut for thatch, mulch and other uses

mature vetiver - vetiver formed terrace on steepish 15% slope Vetiver hedgerow cut for forage As it should be -well vetiver protected farm land Even with gaps the hedge works - roots hold soil slope together.

Another example from Ethiopia is located 150 miles to the east of Mettu district adjoining the town of Anno (location Google Earth: 9° 6'0.60"N, 36°57'53.62"E). Google Earth image of part of Anno farms. Some of the 250 km of Vetiver hedgerows can be clearly seen.

Figure 11: Anno farms showing vetiver hedgerows and area that hold springs that now flow annually because of vetiver related groundwater recharge

Figure 12: Anno farms after harvest - vetiver hedgerow protection

Figure 13: Perennial flowing spring water

Anno farms cover 500 ha, part of which is protected by vetiver - some 270 km of hedgerows. This farm used to be a state farm and was completely run down at the time of privatization. It was deforested, badly eroded and infertile. As a result of applying vetiver grass hedgerows, fertility and crop yields improved significantly, and ground water recharge

improved to the extent that the local spring became perennial rather than seasonal. Some more on this can be found at: http://www.vetiver.org/ETH_WORKSHOP_09/ETH_A5.pdf

Image on above shows some of the vetiver hedgerows on this farm. Slopes vary from 1-10%. Since planting very good crops of maize have been grown even during relatively dry years. This image above shows one of the springs that now flow perennially. Farm staff attributed the better flow to the trees that have been planted around the spring heads. However it was quite clear that the large area of crop land - Figure 12 (above and adjacent to the forest area) that had been protected by vetiver had been the main cause of better spring flow. (Figure 13). Most of the trees immediately above the springs were old indigenous trees that existed even when the spring provided a seasonal flow only - the situation when the farm was released by the state. Farm staff had not made the connection of vetiver hedgerows to ground water recharge. In 2008 a national Vetiver workshop was held in Addis Ababa, the proceedings are at: http://www.vetiver.org/ETH_WORKSHOP_09/ETH-OO%20Proceedings.htm

This paper from China includes some interesting results on the impact of vetiver on various aspects of soil fertility. http://www.vetiver.org/ICV3-Proceedings/CHN_VS_agdev.pdf

These videos related to the above may also be of interest:

https://www.youtube.com/watch?v=ytZ1xgdie5Y

https://www.youtube.com/watch?v=BWLML4tJfMM

https://www.youtube.com/watch?v=iJ2D1QudD0E&t=3s

https://www.youtube.com/watch?v=-IKu8y9PW0M&t=15s

https://www.youtube.com/watch?v=HeQe5VWG3CY

Experience from the East Bali Poverty Project, Indonesia

The Story of the East Bali Poverty Project THE POWER OF VETIVER GRASS

ANNEX 3. SOME SUCCESSFUL VGT APPLICATIONS FOR EROSION CONTROL AND SLOPE STABILIZATION

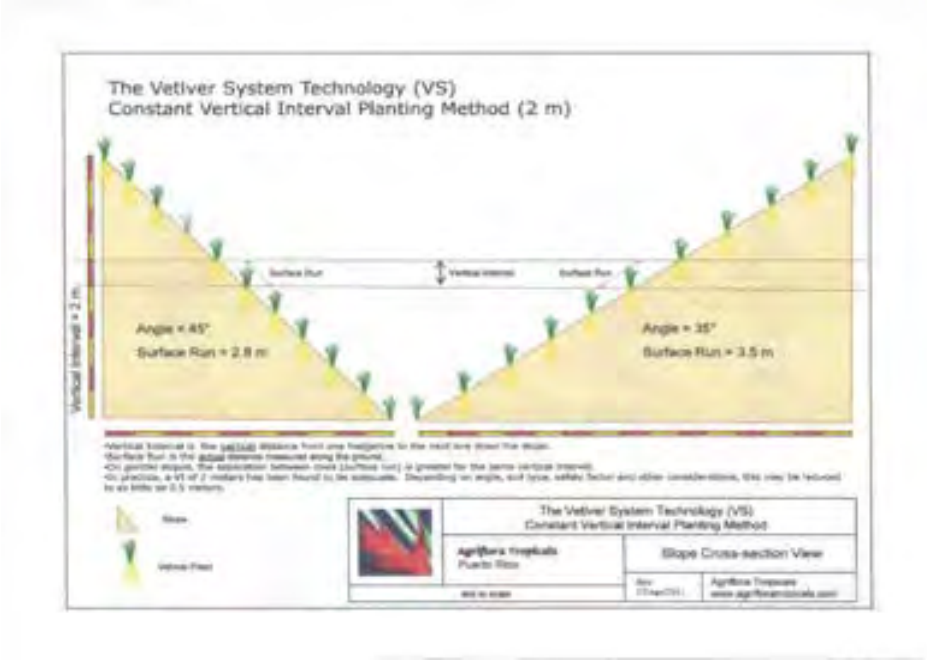
STEEP SLOPES

Rehabilitation of a very steep and erodible slope resulting from a landslip following heavy rain in Australia

DOMESTIC WASTE LANDFILL

Left: Planted around the pit to protect walls and prevent leachate Right: Planted on top of old landfill pit covered with top soil to treat leachate and prevent air pollution (Papua New Guinea)

INFRASTRUCTURE



Design Principle of steep slope stabilisation with VS

DAM WALL


Dam wall protection in Africa and Australia

GULLY


Farm gully erosion control in Australia


Top Left: Gully control - 30 years after planting (Fiji); top right and bottom: Urban gully rehabilitation (Congo)

ROAD STABILIZATION

Road batter stabilisation in semi-arid tropical Australia

Road culvert stabilisation in semi-arid tropical Australia

Left: Rural road stabilization (Panama). Right: Rural road protection (Vanuatu)

Left: Rural road protection (Madagascar) Right: Plantation road protection (Papua New Guinea)

BRIDGE ABUTMENTS

Bridge abutment rehabilitation in Australia

RIVER BANK PROTECTION

Riverbank protection in Vietnam and Bangladesh

Riverbank protection in the Mekong Delta, Vietnam and Australia

Left: Slope protection on bridge abutment (India) Right: River bank and bed stabilization (Malaysia)

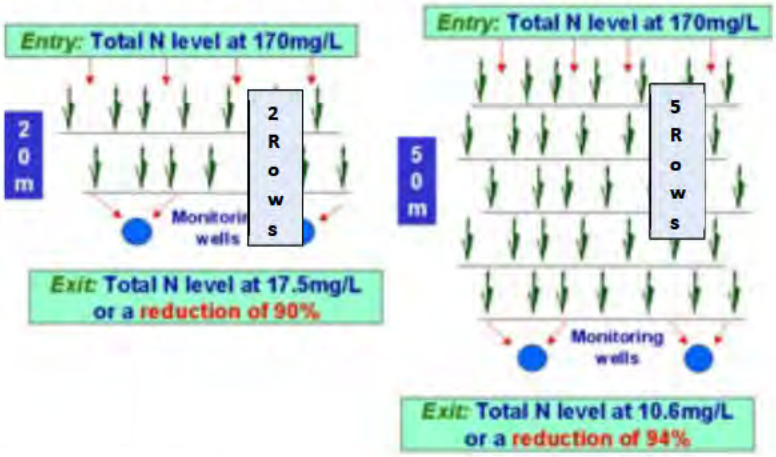
Left: River bank protection (Zimbabwe). Right: Drainage protection (Zimbabwe)

Left: River bank protection of gravel pit site (PNG) Right: Plantation drain protection (PNG)

APPENDIX 4. SOME SUCCESSFULL VETIVER PHYTOREMEDIATION (VPT) APPLICATIONS

Vetiver grass was first recognised in 1995 in Australia for having "super absorbent" characteristics suited for wastewater disposal and developed for such by the applicant, based on his R&D results. During the last 10 plus years VPT has come to be widely used in Africa, Asia, Latin America, USA, and Australia as a proven solution for treating sewage and landfill leachate.

Highly effective in removing Nitrogen



Highly effective in removing Phosphorus

VPT has been thoroughly researched and tested with support and funding from TVNI, Wallace Genetics Foundation, William H Donner Foundation, Australian Government and the Royal Projects Development Board of Thailand . Universities and institutions in Brazil, China, India, Thailand, and Vietnam have verified the potential of vetiver grass for phytoremediation. Many supporting research and case studies can be found on TVNI website at: http://www.vetiver.org

APPLICATIONS IN OTHER GEOGRAPHICAL REGIONS OR SITUATIONS

VPT can function as a constructed wetland or as a dry "filtration" treatment system. It has generic design aspects that can be easily applied from the humid tropics to arid regions. It

operates at a higher degree of efficiency than any other known bio-system. Simple models have been tested and proven to ensure appropriate design specifications. The only limitations to its growth and effectiveness are below freezing temperatures and extreme salinity. Therefore VPT is most applicable within tropical and subtropical zones and in arid zones with moderate winters. These regions are the home to most of the worlds poor.

Australia

VPT has been proven and applied in Australia for 15 years at municipal, small community and household levels**:**

- ***Municipal landfill leachate treatment and disposal***
  Stotts Creek Landfill in New South Wales successfully disposes of 4ML/month of leachate in summer and 2 ML/month in winter on only 3.5ha of VPT area. VPT has been working satisfactorily there for 10 years.
- ***Municipal* sewage effluent *treatment and disposal***
  Toogoolawah in Queensland, with 1,500 residents, successfully disposes of 300KL/day on a 1.0ha VPT area. The table below presents results showing that the pollutants levels are well within the Australian EPA's allowable limits for sewage effluent disposal.

Tests (license requirements)	**Effluent Input**	**Effluent Output**
PH (6.5 to 8.5)	7.3 to 8.0	7.6 to 9.2
Dissolved Oxygen (2.0 minimum)	0 to 2 mg/l	8.1 to 9.2 mg/l
5 Day BOD (20 - 40 mg/l max)	130 to 300 mg/l	7 to 11 mg/l
Suspended Solids (30 - 60 mg/l max)	200 to 500 mg/l	11 to 16 mg/l
Total Nitrogen (6.0 mg/l max)	30 to 80 mg/l	4.1 to 5.7 mg/l
Total Phosphorous (3.0 mg/l max)	10 to 20 mg/l	1.4 to 3.3 mg/l

- ***Small community sewage effluent disposal***
  - **The first case** is a VPT system to treat sewage effluent discharged from a septic complex in a public park. Groundwater monitoring at 2m depth indicates that by passing through 5 rows of vetiver, the levels of total N were reduced by 99% (from 93 to 0.7 mg/L), total P by 85% (from 1.3 to 0.2 mg/L), and faecal coliforms by 95% (from 500 to 23 organisms/100mL). These levels are below the thresholds set by Australia's EPA.
    - Total Nitrogen <10 mg/L
    - Total Phosphorus <1 mg/L
    - *E. coli* <100 organisms/100mL
  - **The second case** is a small, rural community in Queensland. VPT was implemented to comply with new Australian EPA standards. The details are:
    - Vetiver planting areas: $100m^2$
    - Number of plants: 400

- Inflow
  - Average daily flow: 1 670L
  - Average total N: 68mg/L
  - Average total P: 10.6mg/L
  - Average Faecal Coliform:>8 000 organisms/100mL
- Out flow
  - Average daily flow: Almost nil (except after heavy rainfall)
  - Average total N: 0.13mg/L
  - Average total P: 0.152mg/L
  - Average Faecal Coliform:<10

Four hundred vetiver plants on 100m^2 treat 1,670L/day sewage effluent, meeting Australian EPA limits.

- ***Individual household sewage effluent disposal***

  In rural Tweeds Shire, New South Wales, households cannot be connected to the main sewer system. So, the Council requires each household to apply VPT to dispose of its sewage effluent. This program is highly successful.

- ***Computer model development***

  The applicant developed a freely available computer model (http://www.vetiver.org/LAICV2F/2 Environmental Protection/E1Truong_TE.pdf) to scientifically determine the land area needed to dispose/treat municipal, small community, individual household sewage effluent and landfill leachate. This allows all to accurately design their VPT applications.

2. Indonesia

- ***Post—tsunami housing settlement in Aceh*****.** The American and Danish Red Crosses built over 3,000 houses to resettle victims of the 2001 tsunami. Each house includes a VPT sewage system. These units were highly successful and very effective.
- ***Citarum River basin*****.** The Citarum River in Western Java is reportedly the most polluted river in Asia. Industrial waste, trash, sewage and landfill leachate pour uncontrolled into this river. Using Asian Development Bank financing, the Indonesian government implemented VPT to improve river water quality. The treatment strategy comprised:

- Reducing/controlling pollutant inputs by treatment/disposal of sewage effluent from communal latrines along the river
- Reducing/controlling pollutant levels in the river by planting vetiver on river banks and irrigating it with river water

Results to date appear quite positive. While lacking a quantitative assessment, qualitative observations indicate that water quality has improved. Blue-green algae blooms have substantially reduced and fish have returned to some river sections.

3. Haiti

Using VPT principles, Owen Lee has successfully introduced "Vetiver Latrines" to the mountainous village of Pincroix in central Haiti. The Vetiver Latrine is simple. Vetiver is planted around a small concrete slab that covers a slit trench. The long roots of the grass stabilize the pit and uptake the liquid effluent/leachate from sludge in the pit, simultaneously treating it and preventing its movement to groundwater. Above ground, vetiver shoots provide the perfect privacy screen. The design is simple enough for householders to construct themselves with only basic training. Some 12 Vetiver Latrines can be built for the cost of one traditional latrine. To date, 116 Vetiver Latrines have been built by the community, covering 97% of 3 villages. Phase two plans another 250 latrines to achieve 100% coverage of the Pincroix area. A guide for Vetiver Latrine construction is at: http://www.vetiver.org/Vetiver Latrine Guideo_r.pdf

4. **Ethiopia and India**

Technoserve, backed by the Bill and Melinda Gates Foundation, is introducing VPT to Ethiopian coffee pulping stations to treat their wastewater. The initiative is thus far showing good results. The Indian Coffee Board is also promoting VPT for the same purpose. Wastewater from depulping of coffee (large and small-scale) is a major pollutant throughout coffee production areas worldwide, degrading water quality and causing human health problems (skin irritation, stomach problem, nausea and breathing problems). See http://www.technoserve.org/blog/a-sustainable-water-solution-for-coffee-processing-in-ethiopia

5. China

VPT has been used for treating landfills in south China (Guangdong), and most recently for treating effluent from a village sewage project http://www.vetiver.org/CHN_Vetiver_Rural Sewage Treatment.pdf

6. Papua New Guinea

Eagle Vetiver Systems in PNG had the initiative to introduce Phytoremediation using vetiver grass into the Pacific Adventist University. Unlike the computer model treatment site in Stotts Creek by Dr. Paul Truong, waste water is gravitational fed into a 60m X 50m wetland planted with vetiver grass. The walls are also fully stabilized to prevent any leachate from leaching, as well as stabilise pond walls.




Fifteen thousand vetiver slips planted on 3,000m² treat 2,186L/day sewerage effluent.

6.Other

There are many small local/ private VPT initiatives in many countries particularly in Latin America and Asia where VPT is being used for treating a range of needs farm animal effluent to effluent outflows from household septic systems. Most are low cost and reportedly meet the outflow objectives.

ANNEX 5. VISITING AGENT - TERMS OF REFERENCE

1. Role/Purpose

The role of The Vetiver Network International Visiting Agent is to provide strategic direction, leadership and review to ensure the promotion and adaption of Vetiver System is accepted and implemented by concerned stakeholders in both Honiara and Gizo Island, Solomon Islands. The purpose of the twice yearly trips to the Solomon Islands is specifically to assist and provide technical expertise and assist KGA and FAITH carry out awareness, promote adaptability and acceptability of Vetiver System and also to ensure projects are implement in line with guidelines set out.

The Visiting Agent sets out to achieve following outcomes during the duration of the project:

- Project site inspection/visits twice yearly in both Honiara and Gizo Island providing strategic direction and leadership.
- Ensure both implementing agencies are effectively and in timely manner implement proposed projects.
- Carry out interim financial audits and ensure projects costs are spent in line with budgetary allocations and within budgeted limits.
- Assist in identifying problem areas and make recommendations on what best demonstrated practices are to be implemented.
- Provide project inspection report to TVNI and other donors after every visit to the Solomon Islands
- Carry out other tasks as instructed by TVNI from time to time for the effective implementation of the projects during its 3 year term.
- Assist KGA and FAITH to identify best demonstrated project sites and recommend for yearly awards for the Vetiver Field Day.
- Conduct twice yearly meetings and chaired by VA with respective team leaders to evaluate progress of project.
- Assist KGA/FAITH in identifying possible opportunities to market VS to potential and or interested private/public entities to sustain its ongoing operations after project phase.

2. Visting Agent: tentative visit Schedule

Year	Month	Comments
2017/18	Dec/Jan	Official launching of project, nursery establishment and roll out awareness and promotion.
2018	May	First visit to evaluate progress, conduct meeting, visit project sites, identify market opportunities for VST with private/public entities
2018/19	Dec/Jan	Project evaluation, meeting, financial audit, assessment to nominate best demonstrated projects for Vetiver Day.
2019	June	Evaluation and assessment, meeting, identify problems and take correction actions.
2019/20	Dec/Jan	Project evaluation, meeting, financial audit, assessment to nominate best demonstrated projects for second Vetiver Day.
2020	June	Evaluation and assessment, meeting, identify problems and take correction actions.
2020	December	Final Visit, financial audit, evaluation and assessment, meeting, Final Vetiver Day

3. Cost

Costs for the Visiting Agent's visits will be funded through the project funding (it is included in the project proposal). Total costs is inclusive of airfares, accommodation, allowances and meal.

3. Amendment, Modification or Variation

This Terms of Reference may be amended, varied or modified in writing after consultation and agreement by Partnership Group/Advisory Group members.

ANNEX 6 - PARTNERSHIP/ADVISORY GROUP

1. Membership

The Partnership Group/Advisory Group will comprise:

- Dr. Paul Truong, Technical Director, TVNI Asia Pacific (external advice)
- Robinson Vanoh, Country Coordinator PNG, TVNI
- Clement Hadosia, Manager, Kastom Gaden Association Honiara
- John Holland, Team Leader, FAITH Gizo
- (interested stakeholders)

2. Meetings

- All meetings will be chaired by Robinson Vanoh from TVNI (PNG)
- A meeting quorum will be 50% members of the advisory group
- Decisions made by consensus (i.e. members are satisfied with the decision even though it may not be their first choice). If not possible, advisory group chair makes final decision
- Meeting agendas minutes will be provided by Robinson Vanoh from TVNI, this includes:
    - Preparing agendas and supporting papers
    - Preparing meeting notes and information.
- Meetings will be held 2 times annually for (specify time) at specify project sites in Honiara and Gizo and or as decided by the advisory group where convenient for all parties concerned.
- If required subgroup meetings will be arranged outside of these times at a time convenient to subgroup members.

4. The advisory group is accountable for:

- Fostering collaboration
- Removing obstacles to the Partnership's successful delivery, adoption and use
- Maintaining at all times the focus of the Partnership on the agreed scope, outcomes and benefits
- Monitoring and managing the factors outside the Partnership's control that are critical to its success.

5. The membership of the advisory group will commit to:

- Attending all scheduled Partnership Group/Advisory Group meetings
- Wholeheartedly champion the partnership within and outside of work areas
- Share all communications and information across all Partnership/Advisory Group members
- Make timely decisions and take action so as to not hold up the project

- Notifying members of the Partnership Group/Advisory Group, as soon as practical, if any matter arises which may be deemed to affect the development of the Partnership
- Attendance at all meetings and if necessary nominate a proxy.

6. **Members of the advisory group will expect**:

- That each member will be provided with complete, accurate and meaningful information in a timely manner
- To be given reasonable time to make key decisions
- To be alerted to potential risks and issues that could impact the project, as they arise
- Open and honest discussions, without resort to any misleading assertions
- Ongoing 'health checks' to verify the overall status and 'health' of the partnership.

7. KGA and FAITH would be members of the Partnership/Advisory Group and would be responsible foe project implementation including

- Preparation of progress report for the project during the duration of the project.
- Annual budget review and acquittal of all funds, and report back to the donor agency.
- Setting up a committee for the project of promotion on planting Vetiver with Community participation and hold meetings among the committee.
- Setting guidelines and regulations including assessment and evaluative procedures.
- Production plan for young vetiver grass for distribution. Ensure responsible groups produce young vetiver grass within the project site areas.
- Propagating vetiver grass by distributing it to targeted communities.
- Local employment is provided in the targeted areas for producing and caring for young vetiver grass.
- Building of informative signboards at each project site stating the project's name, responsible unit, and funding-provider.
- When young vetiver grass becomes strong distribute them to respective communities as most communities cannot afford vehicles and transportation costs for vetiver grass transportation.
- Promotion and supporting information about vetiver grass for communities.
- Distribution educational and promotional material about vetiver grass to use as documents for the trainings and distribute them to local communities. The materials are in the form of books, pamphlets, posters, and videos.
- Training to ensure knowledge of vetiver grass in the course of developing and promoting the utilization of vetiver to conserve soil and water with community participation.
- Provision of knowledge about vetiver grass utilization for soil and water conservation.
- Creation of understanding to make sure that the locals see benefits of vetiver grass according to the saying, "Plant vetiver grass in people's mind first, then in the areas." This is because the benefits of vetiver grass will not show in a short period of time.

At the same time, awareness will also rise, encouraging communities to promote the utilization of vetiver grass in neighbouring communities and encourage participation among local people.

- Building awareness and motivation by having local activities related to vetiver grass on important days such as the “Vetiver Field Day”.
- Building vetiver grass networks among private organizations, local communities, and youths by having them participate in the program so that they will be the next generation leaders to promote the benefits of vetiver grass, hence encouraging and persuading neighbour communities to plant vetiver grass in their own fields.

ANNEX 7: DETAILED PROJECT COSTS BY YEAR

Task/operation	Total Cost	Year 1	Year 2	Year 3
1. Vetiver slips for planting in agreed pilot location & community nurseries.	10,000	10,000	0	0
2. Visit by TVNI Visiting Agent to the Project sites (Travel expenses – 2 trips/year and fees $2000/year)	19,800	6,600	6600	6600
3. Coordinate Stakeholders in the project sites and review of suitable Pilot project areas	6,000	2,000	2000	2000
4. Community surveys to determine project sites, Present livelihoods and aspirations inputting data and analysis	3,000	2,000	1000	0
5. Field visit to successful Vetiver-based pilot project sites and selected stakeholder trainees to include "Vetiver Field Day"	8,000	2,500	2400	3100
6. Contribution to the local community groups for awareness with the theme "building community resilience to climate change using the Vetiver System".	8,000	2,500	2500	3000
7. Equipment, supplies and documentation: Computer work, Equipment rental, stationeries, etc	6,000	2,200	1900	1900
8. Project management monitoring & evaluations and seminars by TVNI, include visits by Technical Director	6,000	2,000	2000	2000
9. General Administration Costs	3,000	1,000	1000	1000
10. Wages/Salaries – For 4 fulltime employees in Honiara and 3 on Gizo Island	36,000	12,000	12000	12000
11. Transportation Costs	3,000	1,000	1,000	1000
12. TVNI Fee	10,000	1,000	1,000	8,000
Sub-total	**118,800**	**44,800**	**33400**	**40,600**
10% for contingencies	11,880	4480	3340	4060
Total	**130680**	**49280**	**36,740**	**44660**

Tentative Project timetable:

Task	By Whom	Month	Duration
Development of Project Proposal.	RG, PT & RV	June - August	3 months
Review of documentation	RG & PT & RV	Ongoing	
Project Proposal Submission to Donor Agencies	RG	September	
International Travel by VA and Technical Advisor for official launching	PT & RV	December	
Establishment of main nurseries and identifying possible project sites for initial project (Honiara)	RV & KGA	December	
Establishment of main nurseries and identifying possible project sites for initial project (Gizo)	RV & FAITH	December	
Carry out awareness and promotion on VS	KGA & FAITH	Ongoing	
Project Implementation	KGA & FAITH	Ongoing until completion	3 years