Proposal

Irrigated Gardens

below the

Rigo-Rigo river Dam

Limpopo

Prepared by

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for

Sangomo Farmers Association

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Synopsis

The ground immediately downstream of the dam on the Rigo-rigo river, Limpopo Province, is exceptionally fertile and is not being used. It is thus feasible to create 3 hectares of vegetable gardens in this area which may be irrigated very simply by gravity piping water from the dam. No pumps are required as the gardens are below the water level of the dam and the water is thus automatically pressurised.

The community representatives of Sangoma approached Dams for Africa to consider the viability of such gardens and to prepare a proposal that they could use to approach Anglo American for funds.

This project addresses such needs as food security and poverty alleviation. It will also empower the community in terms of imparting agricultural and entrepreneurial skills and create a sense of worth in the participants.

Background

On the 28th April, 2002, at the invitation of the Sangoma Farmers Association (see figure 1) in the Limpopo Province, Mr L Moroasui of People's Agricultural Development (PAD) and the writer of Dams for Africa (DFA) accompanied a delegation to a dam on the Rigorigo river, to investigate its potential as a source of water for irrigating lands lying immediately downstream of the embankment. (The Rigorigo river flows into the Thabina river, which later joins the Letsitele river, a tributary of the Groot Letaba river, at a point about 30km (as the crow flies) downstream of the Tzaneen dam. The water from the Rigorigo thus currently flows into Mozambique without being dammed in South Africa).

The dam lies approximately 3 km SE of the rural village of Sangoma, and its relative position has been plotted on the 1:50000 topographical map '2330 CD Letsitele' (see figure 2). (The position shown is an educated guess, as the dam is not shown on the original topographical map). Figure 3 gives a view across the dam from the wall, while figure 4 shows the upstream embankment.

Figure 5 shows a view of the land 'downstream' of the wall. This ground slopes gently away (about 2%) from the embankment and it therefore appears that there is scope for piping water (which is automatically pressurised as the gardens are below the dam) to thee hectares (100m wide x 300m in length), as indicated in figure 7. The ground is also very fertile, as evidenced by the rich red texture of the soil and the quality of produce being produced in a small vegetable patch (figure 5), which is also the only evidence of any cultivation.

The combination of a reliable and adequate supply of water for irrigation coupled with the fertile soil makes it possible to cultivate high value crops such as vegetables, coffee, or bananas.

Dam and Pipes

It may be seen from figure 2 that the dam's catchment area of 10 km^2 is relatively small in relation to its not insignificant capacity, estimated as 687500 m^3. Assuming an annual rainfall of 800mm, corresponding to its position on the rainfall map, and assuming a runoff of only 50mm, then the inflow into the dam calculates at 500000m^3. Generally vegetables require 60m^3 per day per hectare. Assuming that irrigation takes place at this rate for 300 days per year (less water is required in winter, and no water is required when it rains), then the total yearly requirement for 3 hectares may be calculated as 54 000m^3, or 11% of the annual inflow. Apparently the only use the dam is currently being put to is for drinking water for cattle (see figure 4). It is proposed that a 110mm coupling be welded onto the existing 300mm outlet pipe. This will make it possible to install a small valve on this coupling, from whence a 110 hdpe pipe can take water to the downstream lands as indicated in figure 7.

Figure 1 – Members of the Songoma Farmers Association on 28th April, 2002. The participants of the guide delegation also form part of this group. [They are Jackson Manasi (bottom row left), Ronnie Mhlarhi (front), Stanley Maswakhomu (secretary, centre of top row), Lawrence Moroasui (PAD, bottom row, right)]. Chairperson Sam Mkhari is seated next to Lawrence.

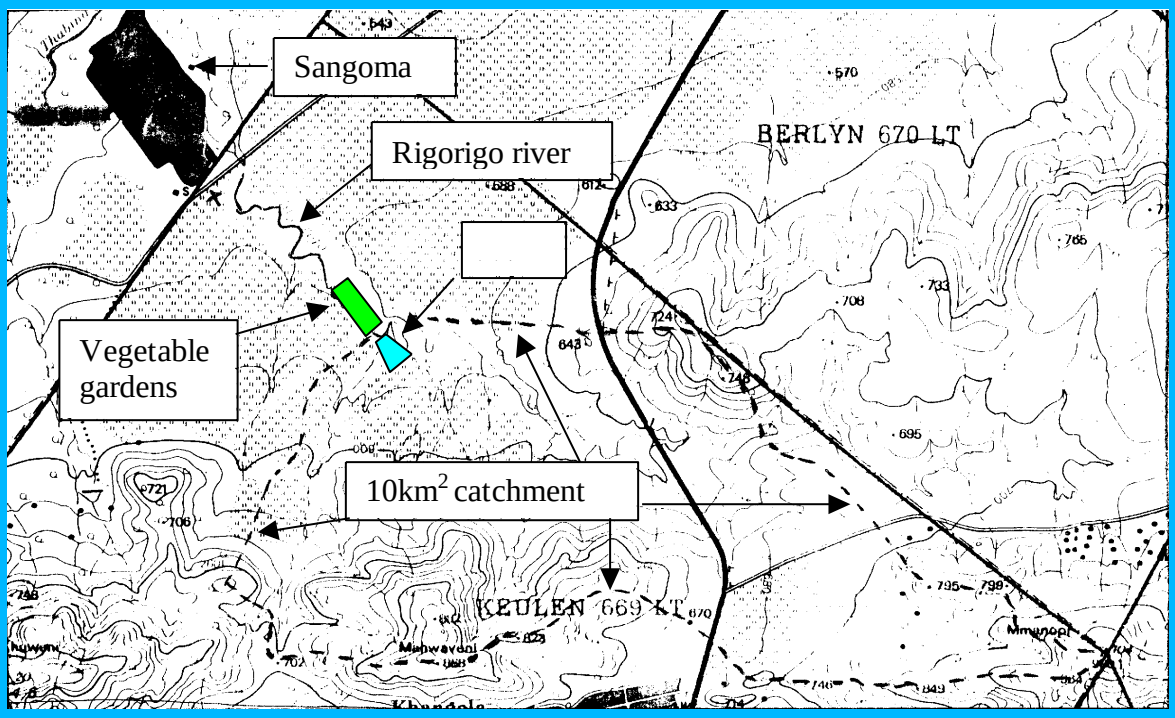

Figure 2 – The estimated position of the dam and the corresponding catchment area are shown superimposed on the 1:50000 topographical map, 2330 CD LETSITELE'.

Figure 3 – View across the dam from the embankment

Figure 4 – View of embankment on upstream side – cattle use the water for drinking

Figure 5 – View from the top of the embankment showing the downstream land. There appear to be many hectares of rich soil (judging from the vegetable patch) that may be irrigated by gravity pressured pipes to yield high value crops

Figure 6 – View of 300mm outlet pipe as it exits in the embankment. By closing the main valve, it will be possible to cut a suitable hole in the pipe and weld on a 110mm coupling so that water may be piped to the fields as indicated in figure 7.

Agricultural Considerations

Irrigable water makes vegetable cultivation viable in the lands beneath the dam, and it is intended that 3 hectares be used to this purpose. Drip irrigation is recommended wherever possible for its water saving potential, but flood irrigation made possible by using hoses may allow greater planting densities with certain vegetable types. In table 1 it is assumed that hoses are used.

The advantages of growing vegetables may be summarised as:

- It is a high value crop (as indicated in table 1).
- The interval between harvesting and planting is only 3 to 6 months (depending on the crop)
- The lowveld climate accelerates growth. For example cabbages may be harvested four times in a year
- Marketing costs are minimal, and it can be arranged that marketers collect the produce from the farms with their own vehicles
- Farming with vegetables is labour intensive, and as such provides many jobs to the local inhabitants

Pipeline Infrastructure

The cost of providing the essential pipeline infrastructure for the 3 hectares is given in table 1. The 110mm hdpe piping system starts at the 300mm steel pipe coming out of the dam, then divides into two 90mm pipes. There are ¾" taps coming off this line at regular intervals, by which the various gardens are supplied with water, i.e. 16 taps per hectare = one per 25m x 25 m garden (see figure 7).

Using 90mm piping for the main arterials friction losses are minimised and it will be possible to develop more hectares downstream at a later date.

Business Plan (see table 1, especially the notes)

The business plan assumes that all production is sold as cash crops – this allows the benefit of the gardens to be quantified. However, it is accepted that the owners of the plots may need to live off some of the produce (food security), and that only part of what is produced can therefore be sold.

The main **capital items** are the irrigation system, equipment and tools, shed/office, training, and start up capital, which are summarised in table 1.

Income is based on the sale of produce (vegetables) that have been priced conservatively, and furthermore it is assumed that only 75% of the 3 ha is being cultivated at any one time.

Expendature covers four areas:

(a) Production costs pertaining to the cultivation of cabbage, beetroot and onion. This includes such aspects as ploughing, fertilizing, seeds, planting, insecticides, weeding, harvesting, fuel, etc.
(b) Water, assumed to cost R0,50/m^3, which is typically what farmers pay for agricultural water.
(c) Overheads, relating marketing/management/technical staff, who are in effect employed by the participants for their expertise, particularly in the initial phase of the project.

The **distributable surplus** of R334150 p.a. for a capital investment of R 443181 is very favourable. This will be shared out between the participating farmers based on their individual outputs, and for 48 participants, the average distributable surplus would be R6961 pa. Clearly the large number of participants severely diminishes the return on an individual level. An employee working on the shop floor of a factory may expect to earn this in four months.

However, before dismissing this return as totally unattractive, and judging the concept as not worthwhile, other considerations should be taken into account.

(1) R 6961 is much better than no income, and it may be argued that it is in fact a good return for a piece of land that is only 1/16th of a hectare. For some it may be the difference between starvation and survival.

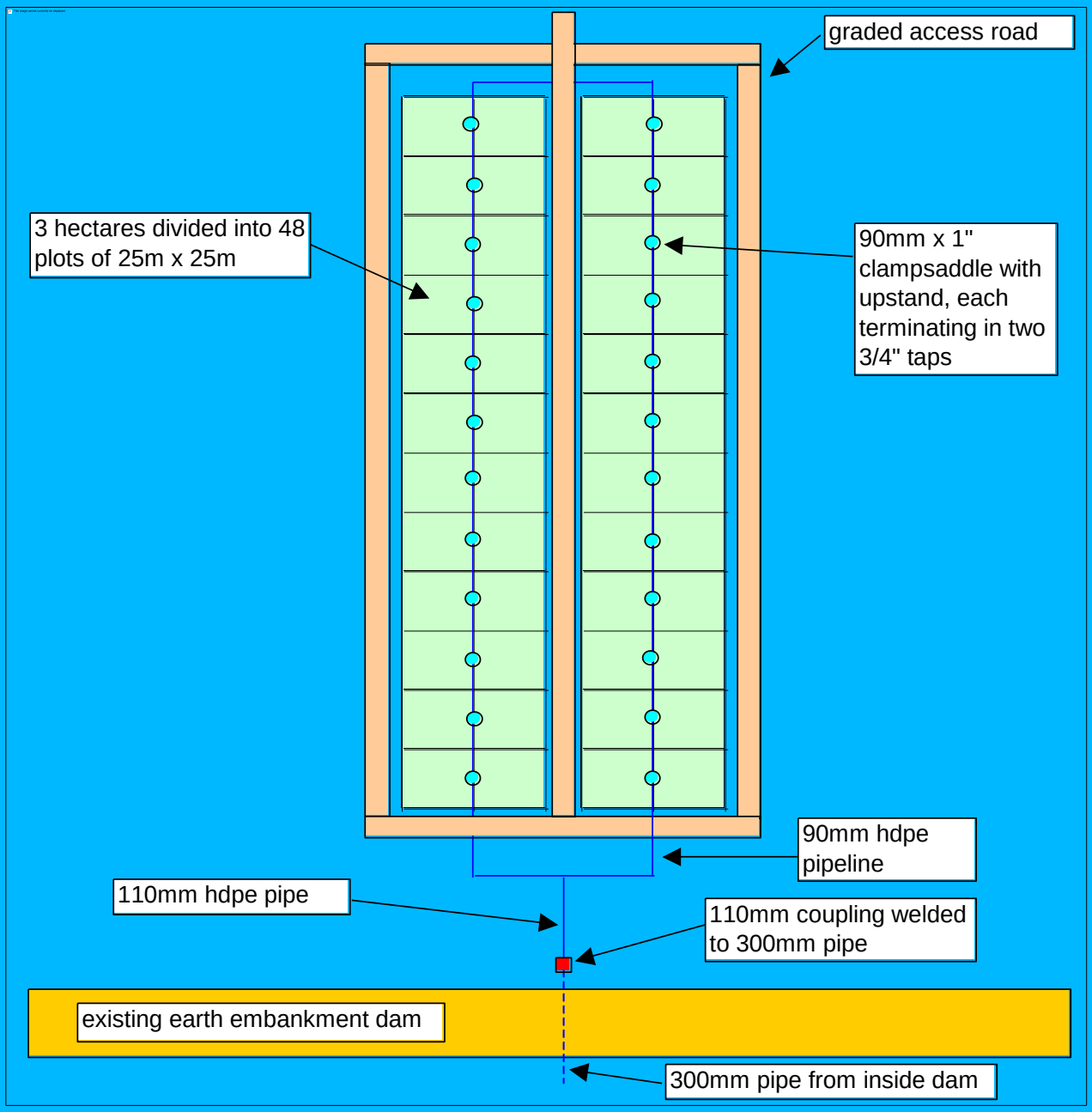

Figure 7 – Layout of pipelines from existing dam to 3 hectares of irrigated fields. There are a total of 48 plots of 25m x 25m. Water is gravity fed to taps placed at regular intervals, which become the starting point for either hoses or drip irrigation.

(2) The money is earned by the plot-holder, and this gives him/her a sense of worth, purpose, dignity and status – particularly in a rural society where jobs are very scarce and any form of income is welcome.

(3) Although as a migrant factory worker in a distant city the individual may earn much more in wages, he/she has to commute daily to work, most probably from some form of rented accommodation in a township, which not only costs money but also takes perhaps 2 to 4 hours a day, whereas the garden plot is within walking distance, and the individual determines his own working hours. Especially for women with families, this allows them not only to be with their families, but to see the children off to school before they walk up to their plot.

A further point is that migrant factory workers are generally forced to stay in some form of rented accommodation, often substandard. Not only is this another cost, but there are negative social consequences in a society where the children grow up without the love and care of their parents. On the other hand the garden worker is at home with his/her family.

(4) A significant advantage of a garden is that by increasing the productivity by just a few percentage points (currently assumed to be 75%), the plot-holder can feed his family off the additional production (again a noteable saving) without reducing the saleable stock. Irrigated gardens thus represent the means to food security, and in so doing redress one of mankind's most primal fears.

(5) It is quite possible that there will be fewer than 48 participants. This can happen from a process of natural attrition whereby uncommitted/disinterested plot-holders are made to give their plots to good performers. If there are say only 12 people from the community that are willing to take on the related responsibilities and challenges of farming, each farmer could be allocate a quarter of a hectare in this case (rather than a sixteenth in the case of 48 participants). This has the potential for a 400% increase in the individual's surplus.

(6) By growing the correct quantities of the various types of vegetables, as well as other subtropical produce such as bananas, it may possible to dispose of the bulk of the produce to the surrounding villages. The associated savings in marketing and trucking of produce allows a higher price to be fetched by the grower, easily 50% more according to one study. If additional growing space is still available, then produce that is relatively insensitive to transport, such as coffee, should be considered. An increase of 50% in the selling price increases the 'surplus' by 104%.

Sectional Summary and Conclusion: The benefits mentioned in points (1), (2), (3), (4) are very important, but have not been quantified. On the other hand this *has* been done for points (5) and (6). The corresponding potential increases mean that the eventual average distributable income per quarter hectare holder increases by:

R 6961 x 4 x 2,04 = R 56802 pa, and this *is* considerably more than what a migrant worker earns.

The financial and social benefits described above will reduce urban migration, and hence the level of unemployment in the cities, resulting in less crime. Ultimately this means fewer police, prisons and courts, which collectively currently cost the country R 31,8 billion. It also means well nourished children, who will have the mental energy to concentrate in the classroom and do well at school, will get good grades rather than fail, and this translates into savings in the education budget (currently R59 billion). Good nutrition also means fewer malnourished babies and healthier rural population, resulting in savings in the health budget (currently R33,5 billion).

If water schemes/gardens as described here are able to reduce the budgets described above by as little as 0,1%, (i.e. R1 of every R1000) this will save the country R 124,3 million on an ongoing basis. It may therefore be argued that government should invest at least such an amount in water/garden projects of this nature, and this addresses the problem at source, leading to prevention rather than merely treating the symptoms.

Conclusion

This proposal was developed in response to a request by the Sangoma Farmers Association. Its strength lies in the fact that water is supplied from an existing dam that is very near, and that this water may be gravity piped to the gardens, so that there are no pumps to breakdown or electricity costs involved.

Note that there is ample ground below the designated 3 Ha area for future expansion, and it will be a very simple matter to extend the pipes further down the hill.

The proposal addresses fundamental issues such as food security, poverty eradication, job creation, entrepreneurial development, and establishes a rural micro-economy – resulting in less urban migration with all its associated social problems.

Table 1 - Business Plan

	unit	qty	unit cost	total	
Capital Expendature [3]			R	R	
Engineering fascilitation				6000	
Fascilitation, Training, Mentering [5]	persons	48	1000	48000	
[11]				92524	
[9]	ha	3	5000	15000	
[10]	plot	48	1000	48000	
roadworks [12]	km	1	5000	5000	
Project management fees	%	10		23179	
Start up capital [13]				120425	429394

Income from Vegetable Crops

Type	Selling Price [1]	Density/ha	months to maturity	Equivalent monthly	Equivalent annual	
[4]					191667	

Expendature

Production costs/ha [2]	ha x crops/yr	9	12000	108000	
Water usage [14]	m^3	65700	0.5	32850	140850

Overhead costs

Marketer/supervisor/advisor				40000	
Agricultural mentoring fees				20000	
Fascilitation Fees				20000	
Telephones/electricity/stationery				20000	100000

Distributable Surplus [6] 334150

Note

1 The selling prices used here may be regarded as conservative
2 A unit value for production costs of R12000 to R15000 for a single crop was obtained from the Agricultural Reseach Commision (Dr Finnie Niederwieser), and pertains to cabbage, beetroot and onion production. They include such aspects as ploughing, fertilizing, seeds, planting, insecticides, weeding, harvesting, labour, supervision, fuel. They exclude capital items such as tractors, irrigation systems, sheds, etc. The lower figure of R12000 is used since 'supervision' is budgeted for under overheads. Furthermore the 'labour' cost is taken as zero, since the participants are all entrepreneurs who are remunerated via their share of the surplus.
3 VAT excluded
4 The 'utilization' is reduced to to 75% to allow for some inefficiencies.
5 Training will include the fundaments of cultivation, irrigation, productivity, business principles, etc.
6 A record will be kept of each farmer's expenses and income to arive at the distributable surplus that each farmer is entitled to.
9 Farm establishment covers such aspects as clearing trees, ripping, etc.
10 Equipment includes such items as spades, hoes, sprayers, barrows, 30m dragline etc.
11 This does not include a drip irrigation system, but this can easily be added lated on a piecemeal basis by installing a pressure regulator between each tap and a 50mm surface pipe from which the dripper lines eminate (12mm x 1mm thick dripper lines spaced at 1m). Perforations are 1mm in diameter and are spaced 300mm appart. They allow 2 litres per hour.
12 Implies a simple scraping exercise with a grader, possibly with some shaping of the road's profile to get the water off. Thereafter each entrepreneur should maintain the road adjacent to his/her plot. A serviceable road is an important aspect of getting the produce to the market.
13 Start up capital is taken as 50% of the 'overhead' and 'expendature' costs, which allows for 6 months before generated income from the sale of produce starts paying for running expenses.
14 Water usage is based on 6mm/day x 3 ha x 10000m2/ha x 365 days/yr. This is clearly conservative given that no irrigation is required when it rains, and that the projected production efficiency is only 75%, but it does allow for future expansion.

About Dams for Africa

Dams for Africa are turnkey project engineers committed to the **sustainable empowerment of communities** in remote rural areas by means of dam-construction/water-supply, for irrigation/agriculture as well as purification/reticulation.

The firm recognises the need to be **flexible** and will tailor its involvement according to need, from minor consultations to relatively large turnkey construction projects.

The firm's contribution to a **typical project** would ideally be an initial feasibility study, followed by the design and supervision of the dam construction and related canals/pipes for irrigation to farms. The scope of the work may also extend to the construction of a water purification facility and related reticulation to houses.

Ideally **labour intensive** methods (that are at the same time cost effective) will be used in the construction process.

The firm is also in a position to provide the necessary hydrological, topographical, geological, ecological and social impact **studies**, and attend to the technicalities and legalities associated with a dam.

Dams for Africa fully appreciates the need to **network** and co-operate with partners such as:

1. *Community based organizations* that are in touch with the needs of the resident population.

The firm is aware of the importance of *community involvement* and is, if required, prepared to participate in all stages of this process. This would include a response-to-need request as the first step, assistance with visualization, participation in negotiations, recruitment and training of local residents for the construction stage, facilitation of training in subsequent agriculture and irrigation, and ongoing mentoring as may be required.

2. *Donors/funders* and

The company is prepared to participate in *fundraising* for

3. *Training organizations* who teach on farming-methods/produce-marketing, and who have a heart for ongoing mentoring if required.

The firm would like to know that its engineering contribution is placed in the hands of a motivated community that has been *equipped*

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