New Partnership for
Africa's Development (NEPAD)

Comprehensive Africa Agriculture
Development Programme (CAADP)

Food and Agriculture Organization
of the United Nations

Investment Centre Division

GOVERNMENT OF ERITREA

SUPPORT TO NEPAD–CAADP IMPLEMENTATION

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Volume II of V

BANKABLE INVESTMENT PROJECT PROFILE

Hazemo Plains Integrated Development Project

January 2005

ERITREA: Support to NEPAD–CAADP Implementation

Volume I: National Medium–Term Investment Programme (NMTIP)

Bankable Investment Project Profiles (BIPPs)

Volume II: Hazemo Plains Integrated Development Project

Volume III: Tseada–Kelay Plains Integrated Development Project

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NEPAD–CAADP BANKABLE INVESTMENT PROJECT PROFILE

Country: Eritrea

Sector of Activities: Agriculture

Proposed Project Name: **Hazemo Plains Integrated Development Project**

Project Area: Debub Administrative Region

Duration of Project: Five years

Estimated Cost: Foreign Exchange..... US$17.39 million
Local Cost..... US$3.50 million
Total.....US$20.89 million

Suggested Financing:

Source	***US$ million***	***% of total***
Government	2.09	10
Financing institution(s)	17.34	83
Beneficiaries	1.46	7
Private sector	–	–
Total	***20.89***	***100***

ERITREA:

NEPAD–CAADP Bankable Investment Project Profile

"Hazemo Plains Integrated Development Project"

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Abbreviations

AWPB	Annual Work Plan and Budget
BIPP	Bankable Investment Project Profile
CAADP	Comprehensive Africa Agriculture Development Programme
CBO	Community–Based Organization
FAO	Food and Agricultural Organization of the United Nations
GDP	Gross Domestic Product
HH	Households
HPDP–1	Hazemo Plains Development Project – Phase 1
IDPs	Internally Displaced Persons
IFS	Integrated Farming Schemes
MoA	Ministry of Agriculture
NARI	National Agricultural Research Institute
NEPAD	New Partnership for Africa's Development
NGO	Non–Governmental Organization
NMTIP	National Medium–Term Investment Programme

I. PROJECT BACKGROUND

A. Project Origin

I.1. The present project profile is being formulated within the framework of the *New Partnership for Africa's Development* (NEPAD) to support the implementation of the *Comprehensive Africa Agriculture Development Programme* (CAADP). It is to be recalled that CAADP has been given a strong political support by the Heads of State and Government of the African Union during the Second Ordinary Session in Maputo, in July 2003. Among other things, the Heads of State and Government committed themselves to allocate 10 percent of the national budgetary resources to the agricultural sector within five years. To this end, the FAO has been requested to assist the member countries in preparing *National Medium–Term Investment Programmes* (NMTIP) and a set of *Bankable Investment Project Profiles* (BIPPs).[1]

I.2. The government completed the preparation of the NMTIP for Eritrea with the assistance of FAO in September 2004. As intended, the NMTIP has articulated government's development strategies and priorities and identified major areas for investment in the medium–term, taking into account their relevance to one or more of the five pillars of CAADP. The proposed *Hazemo Plains Integrated Development Project* has been recognized as one of the priority development areas, and has been selected to become an integral part of the medium–term investment plan as outlined in the NMTIP.

B. General Information

I.3. Eritrea has a total population of about 4.48 million, of which some 70–80 percent is considered rural. Of the total land area of about 12.4 million ha, 1.65 million ha is arable and roughly 0.6 million ha is suitable for irrigation. The area cultivated per year averages about 530,000 ha and only 28,000 ha are currently irrigated, leaving considerable potential for expansion. The country has numerous ecological zones due to its topography, which comprises altitudes that range from sea level to peaks of over 3,000 m above sea level. The diversity of ecosystems makes the country suited to produce a wide variety of tropical and temperate crops.

I.4. Although the majority of the population lives in the rural areas, agricultural contribution to the Gross Domestic Product (GDP) is relatively modest, accounting for only about 12 percent in recent years. Among other things, this highlights the low value of agricultural production, reflecting the dominance of rainfed crop production by subsistence farmers and livestock rearing by pastoralists. Yield of crops are very low, varying from 0.2 to 1.5 tonnes/ha depending on rains. Likewise, productivity of livestock is also low and subject to the vagaries of the climate. In the past few years, poor and erratic rains have lead to frequent droughts, discouraging farmers from adopting modern agricultural practices, thus exacerbating rural poverty. In addition to the drought conditions, the country's soils are seriously eroded, particularly in the highlands, as the result of deforestation, overgrazing and inadequate resource management which is contributing to low agricultural productivity. Since 1998, agricultural production has also been affected by the war with Ethiopia as

[1] For the purposes of the present exercise, *"Bankable Investment Project Profiles"* are defined as documents elaborated in a format and with the information that could make them favourably considered by the financial institutions, donors and private investors foreseen in the Maputo Declaration. These documents should enable cooperating partners to make preliminary indications of interest, and of approximate level of funding commitment. Further feasibility analysis and subsequent processing through the concerned partner(s) regular project formulation systems would follow to obtain a project/programme proposal elaborated to the feasibility study level.

many farmers have been displaced and production systems disrupted. The country is dependent on food aid and its annual import requirements vary from 25 to 50 percent, depending on rainfall.

I.5. It is widely recognized by practitioners and policy makers in the country that current agricultural production practices are not sustainable. Therefore, the government has been endeavouring to address the issues related to traditional farming practices and resource conservation in order to improve agricultural productivity. It launched a major development programme known as the *Integrated Farming Schemes* (IFS) whose main thrust was to increase crop production through the use of modern farming practices, namely the provision of fertilizers, seeds, machinery ploughing and harvesting services. The result of this programme was mixed but general observations are that little impact was made in the shallow and poor soils of the highlands, which are characterized by erratic rains, while significant yield increases were recorded in the south western lowlands, where soils and rainfall are relatively better. The same observations were made following the implementation of other development programmes such as *Sasakawa Global 2000*, the FAO *Special Programme for Food Security* and other area specific development programmes.

I.6. A number of useful lessons have been learnt during implementation of these and other similar development programmes in the last decade, including the following which deserve due consideration while designing future development programmes:

- provision of drought resistant crop varieties and adoption of moisture conserving cultural practices are important in mitigating rainfed crop failures when rainfall is below normal patterns;
- whenever possible, efforts should be made to shift farming towards irrigated agriculture (year round irrigation, supplementary or spate–based) to secure harvests;
- promotion of rational range management systems for livestock production in order to utilize such resources on a sustainable basis;
- rehabilitation of the environment for better soil and water conservation should be considered as an integral part of agriculture development; and
- the provision of support services should respond to critical problems of the individual farmers and their communities.

II. PROJECT AREA

II.1. The Hazemo plains, located in Zoba Debub in the Debub Administrative Region, are vast in area by the standards of the Eritrean highlands. There are at least four main subcatchments that feed into the Hazemo plains. Given its size, it is generally considered unrealistic to attempt developing the area as a block. Therefore, investment plans to develop the plains must be carried out in phases, to take account of the Region's limited implementation capacity and the paucity of budgetary resources. In addition, experience that would be gained during the implementation of a relatively smaller area will be useful in providing valuable lessons to the future development plans of the plains.

II.2. Against the above background, a first phase development project is being proposed to comprise seven sites along the basins of the Agula, Sebene/Gensel, Middle Mereb, Hames Chealo–Hadadim and Tserona Rivers. These are mostly located within the Mai–Aini Sub–Zoba (see map in Annex 1). The *Hazemo Plains Development Project – Phase 1* (HPDP–1) has a gross area of about

1 570 km^2 of which 445 km^2 is the Tedrer–Hazemo plain, which is the main focus area of the project and the remaining 1,125 km^2 is part of the upper catchment. The main river that drains the subcatchment waters is the Mereb River.

II.3. ***Location, Land and Population.*** The location of the project area of the HPIDP–1 is shown in the Map in Appendix 1. The area is bounded on the east by Adi Kaih – Seneafe ridge, on the north by the Dekemehare–Segeneit asphalted road, on the south by Belesa and Tserona River and on the west by the eastern face of the Mendefera Plateau. There are about 16,605 households (HH) out of which 13,330 are direct beneficiaries and 3,320 are indirect beneficiaries. The total population in the project area is estimated at about 75,867 living in 176 villages.

Table 1: Population and Land Area Use of the Project Area (Hazemo)

Site	Vil-lages (No.)	HH (Nº)			Pop			Land Area to be developed (ha)						
								Irrigated						
		DBHH	IDBHH	TBHH	DBPP	IDBPP	TBPP	Horti-culture	Cereals	Forage	Total	Grazing	Rainfed	Total
Agula	9	920	–	920	3,903	–	3,903	985	–	15	1,000	1,200	–	2,200
Middle Mereb	22	1,707	–	1,707	8,157	–	8,157	4,000	–	–	4,000	14,000	2,000	20,000
Sebene/Gensel	58	5,639	1,360	699	24,173	6,461	30,634	1,020	1,110	30	2,160	–	–	2,160
Lower Mereb	–	–	–	–	–	–	–	–	–	–	–	7,800	–	7,800
Hames	7	679	–	679	3,094	–	3,094	–	400	–	400	–	–	400
Chealo–Hadadim	31	2,643	–	2,643	12,493	–	12,493							
Tserona	45	1,742	1,915	3,657	7,525	10,061	17,586							
Total	176	13,330	3,275	16,605	59,345	16,522	75,867	6,005	1,510	35	7,560	23,000	2,000	32,560

DBHH Direct Beneficiary Households IDBHH Indirect Beneficiary Households TBHH Total Beneficiary Households

DBPP Direct Beneficiary Population IDBPP Indirect Beneficiary Population TBPP Total Beneficiary population

Note: Horticulture and forage crops are year round irrigation and cereals are supplemented by spate irrigation.

II.4. ***Physical Characteristics and Climate.*** The project area is generally flat with gentle inclination of about 1.7 percent from east to west. Average altitude is 1,440 m above sea level. The plains are surrounded by rugged mountains on the east and north. Soil types are clay loam to sandy loam, well drained with average depth of 2 m. The climate in the project area varies from warm to hot. The coldest month is December with average temperature of 15^{o}C, while the hottest month is May where average temperature reaches 30^{o}C. Mean annual temperature is 24^{o}C. The rainfall pattern is part of the central highlands, where the poor distribution and the erratic nature of the rains has lead to frequent droughts and crop failures. Statistics show that the average annual rainfall is about 536 mm (Mai Aini 1997–2003). As an illustration of variability of rainfall it suffices to indicate that the annual rainfall in 2003 amounted to only 354 mm, while that for 2001 was 633 mm. Given such moisture related problems, rainfed crop cultivation and extensive livestock production have been increasingly marginalized, putting the livelihood of thousands of families in jeopardy — a trend which is progressively increasing. The most successful farmers in the area are those few households who are able to use some sort of irrigation.

II.5. ***Land Use and Land Tenure.*** About 22,130 ha or slightly less than 50 percent of the project area is arable land and some 15,650 ha are cultivated annually. Vegetation cover by shrubs and acacia account for about 22,850 ha, and the rest of the area consists of barren land and watercourses.

II.6. Up to about thirty years ago, the prevalent land tenure system was a combination of free holding from the community and lease holding from the State. This was changed in the mid–seventies to *diesa* land, which is a communal ownership system within the village administrative setup. Under such tenure arrangements, the land is subdivided equitably among the village households and is rotated periodically, mostly every seven years. This tenure system, which is prevalent all over the

Eritrean highlands, is recognized as one of the main hindrances to investing in land improvement and in adopting improved farming methods such as irrigation, intensive livestock system and land management practices by farmers. Given the periodic rotation of farm and parcels, individual farmers have no incentive in incurring long–term investment in land improvement and soil and water conservation activities.

II.7. It is interesting to note that the few individuals who have been given a long–term lease of some irrigated land by the government are keen to allocate resources to land protection and improvement. Many members of the community are now requesting to have a long–term lease hold, but their demands have not been met yet. The concession of long–term lease hold to some farmers has become a source of friction within the farming community in the area.

II.8. ***Surface Water.*** The major surface water source for future development of the project area is the Mereb River which rises southwest of Asmara, near mount Tekera, and flows southeast and south bounding the two plains on north east and east until it forms part of the border between Eritrea and Ethiopia. Its major tributaries are the Finkika, Gensel, Chealo–Hadadim (Etaro) and Tserona rivers, which discharge their flows at the top of these plains.

II.9. Because long–term flow data is not available for Mereb and the other four rivers, the estimation of annual average flows were made based on previous estimates using hydrological modelling and simple empirical rainfall–runoff equation. Table 2 presents the total annual discharge of the major rivers reaching and crossing the project area including their irrigation potential. Recent reconnaissance irrigable land classification has indicated that about 22,000 ha of Tedrer and Hazemo plains are moderate to marginal irrigable land (Euroconsult, 1998).

Table 2: Average Annual Flow and Irrigation Potential of Major Rivers Crossing the Project Area

River Name	Drainage Area (km^2)	Avg. Annual Rainfall (mm)	Estimated Annual Run–off (Mm^3)	Irrigation Potential (ha)
Mereb at Selalih*	1 075		85.6	8 560
Fenkika at mouth of Zerto Valley*	134		8.5	1 000
Gensel at Mai Aini*	638		37	3 700
Etaro at Chealo and Hadadim junction(Etaro)	264	410	11.9	–
Hammes	92	410	4.1	410
Tserona near Tserona village	474	410	21.3	2 370

* Source – Upper Mereb Water Supply Study (NRCE, 2004)

Total irrigation potential of rivers crossing Hazemo and Tedrer Plain is estimated about 15,890 ha

Total Irrigable land available with in the Hazemo and Tedrer Plain including Agula valley is 22,130 ha

II.10. ***Groundwater.*** The major aquifers for ground water abstraction in the project area are the alluvial deposits found along the river valleys of Mereb, Seben–Gensel, Tserona and Finkika (Agula–Zerto Valley). In all the valleys the depth to groundwater is less than six metres but ground water levels vary from area to area. There has been a significant drop of groundwater level because of extensive pumping in the upper catchment in the Agula valley. Presently, a well in the Agula valley can only irrigate about 2 ha while a well dug in the other three valleys can irrigate a minimum of 10 ha. This shows that the ground water storage and the transmissivity value of aquifers with in the Mereb, Sebene–Gensel and Tserona river valleys are higher to sustain more irrigated agriculture. Since recharge in these three valleys is high, increasing groundwater storage by putting some abstractions for courser sediment deposition could help to expand irrigated agriculture. Presently a total of 17 million cubic metres of ground water can be sustainably pumped annually to irrigate a total of about 1 700 ha of land.

II.11. ***Existing Irrigation Practices.*** Presently there are about 228 ha of land under irrigation along the banks of Mereb, Finkika, Sebene–Gensel and Tserona Rivers using pumped water from wells dug in the river bank alluviums, while spate flow diversion and spreading is the only irrigation practice at the foot hills of Chealo–Hadadim and Hames. Availability of capital to dig wells and purchase pumps is the major constraint for expansion of year round irrigated agriculture. In the spate irrigated areas, inability to control spate flows, unreliability of flood occurrence and farm land losses are the main constraints facing crop production.

II.12. ***Crop Production.*** The farming system in the area is mixed rain–fed crop and livestock production. However, seasonal and perennial irrigation is also practiced to a limited extent. The seasonal irrigation is mainly spate–based (water spread) essentially for cereal production, while perennial irrigation is largely derived from underground water for horticulture crop production.

II.13. The main crops grown in the project area are teff, maize, sorghum, finger millet and chick pea. Horticultural crops that include vegetables (tomato, pepper, onion) and fruits (orange and lemon) are produced along the riverbanks of Gensele, Sebene, Agula and Mereb in a very limited area. However, the productivity of crops has in general declined in the last decades due to recurrent drought and erratic rainfall that lead to low soil moisture. Other factors that affect the production of the area are low inputs of fertilizer, weeds and use of traditional varieties, natural resource degradation due to deforestation and overgrazing leading to soil erosion, reduced soil fertility and poor water retention. In addition to these the recent war with Ethiopia caused disruption of the agricultural production system of the area.

II.14. Because of the above–mentioned reasons, the current farming systems are not able to guarantee people's livelihood. Average major crop and sorghum yields and total annual production over the past seven years are shown in Table 3 below. As it can be seen, yields are only a fraction of what could be achieved if improved and sustainable production techniques are adopted. The low yields provide a good opportunity for raising them significantly through the introduction of improved faming practices.

II.15. Table 3 also shows the low productivity of rain–fed farming and demonstrates that the agricultural sector of the project area is not providing the necessary income to enable farmers subsist through the whole year. Table 3 shows that there is yield difference in good and bad rainy seasons. Highest yields are recorded during good rainy years and vice versa during poor rainy seasons. This shows that rainfall is the main limiting factor for crop production in the area. Hence the people must get other incomes such as from casual labour, if any, support from relatives working in the urban areas or abroad or obtain food aid.

Table 3: Yields and Production of Sorghum, Tomato and Pepper in Hazemo (1996–2003)							
Year	Sorghum					Tomato average yield (tonnes/ha)	Pepper average yield (tonnes/ha
	Area under production (ha)	Total actual production (tonnes)	Average yield (tonnes/ha)	Potential yield (tonnes/ha)	Total potential production (tonnes)		
1996	2,133	1,279.8	0.6	1.2	2,751.1	8	6
1997	1,846	923.0	0.5	1.5	2,769.0	9	8
1998	4,781	6,274.4	1.1	1.8	8,605.8	12	10
1999	1,284	642.0	0.5	1.1	1,412.4	7.5	6
2000	1,542	925.2	0.6	1.4	2,158.8	6.7	5
2001	759	607.2	0.8	1.3	986.7	9	7
2002	5,327	1,065.4	0.2	1.5	7,990.5	7.5	7
2003	3,914	1,957.0	0.5	1.6	6,262.4	8.2	6.5
Source: MoA Zoba Debub.							

II.16. ***Livestock Production.*** In previous decades, the Hazemo Plains used to be an important food producing area and the mixed rain crop and livestock farming was a viable system. Production of teff and sorghum as well as goats and cattle were important sources of domestic food supply. The productivity of this system has dwindled over the past few years for several reasons, including: natural resource degradation due to deforestation and overgrazing leading to soil erosion, reduced fertility and poor water retention property of soils; changed land tenure arrangements which interfered with traditional fallow practices; changed rainfed pattern that has triggered frequent drought conditions; and the war with Ethiopia which was the cause for disruptions of agricultural production in the area.

II.17. The animal species raised in the project area are indigenous and include, in order of importance, cattle, goats, sheep and camel. The first two are dominant and their proportions vary with various project sites. The estimated populations are 22,493 cattle, 17,399 goats, 16,149 sheep and 1,824 camels.

II.18. The production system is an extensive system and the main source of feed is poor communal grazing land supplemented with crop residue. The main consumers of crop residue, however, are ox. The majority of households own small size sheep or goat flocks where the size per household is 5–10 animals; cattle ownership is fewer and the average herd size per household is 3–5. Children traditionally herd animals, but because of school attendance this practice is diminishing, creating a serious labour shortage problem. Animals suffer from severe malnutrition during the dry season and high death rate is common in drought years.

II.19. The productive and reproductive efficiency of livestock is low. Most livestock have low milk yield, growth rate and reproductive rates. Hence the role of livestock as a vital source of cash, food and manure for cropping is progressively dropping. Households owning livestock are always better off with their livelihoods particularly in years of crop failure.

II.20. The main constraints include lack of feed and drinking water influenced by the unreliable rainfall, disease, and poor management system. However, there are good opportunities to develop livestock in the area through intensification and particularly by integrating it with irrigated cropping wherever possible because the present extensive model is no longer sustainable. In most of the selected project sites, there is potential grazing land and groundwater which can be developed to produce high value livestock products. Implementation of this will greatly improve the livelihood standards of the involved populations and will ultimately contribute to the national goals of food insecurity and poverty reduction in the long term.

II.21. Traditional livestock production in the area is based on free roaming of animals to graze and browse. As a consequence, the poorly endowed natural grazing areas are overgrazed leading to overall environmental degradation, low productive and reproductive efficiency as well as to serious loss in body weight or even to diseases and/or death of the animals. Over the years, population pressure and cropping intensity have pushed livestock to the marginal land of rugged, stony and barren hills. As a result, feed storage is severe during the dry season. Drinking water is also in shortage. Thus, malnutrition, lack of water, disease and water rearrangement are the main factors affecting performance of livestock in the area. Major production parameters of livestock are very low as shown in Table 4. In effect, the aim of livestock keeping has almost become for survival rather than for productive function.

II.22. Because of the above mentioned reasons, the prevalent farming systems, i.e. the mixed rain–fed crops and extensive livestock production has become a system that is not able to guarantee people's livelihood. Given the low productivity of rainfed farming and livestock production, it is clear the agricultural sector is not providing the necessary income to enable farmers to subsist the whole year round. Hence people must get other incomes such as from casual labour, if any, support from relatives working in the urban areas or abroad or obtain food aid.

Table 4: Average Production Coefficient of the Present Production Model in the Extensive Livestock System

Parameter	Goat	Sheep	Cattle
Age at first kidding/lambing/calving (month)	17	20	45
Twinning rate (%)	12	10	–
Kidding/lambing/calving percentage	110	100	50
Kids/lambs/calves born per doe/ewe/cow per life time		6	8
Kid/lamb/calf mortality/year (%)	10	11	7
Kidding/lambing/calving interval (month)	12	12	22
Lactation period length (day)	90	–	150
Milk yield per lactation per doe/cow (litre)	18	–	225
Average flock size (No)	14	8	5
Age at slaughter weight (month)	20	18	48
Slaughter weight (kg)	20	27	220

II.23. ***Socio–economic Infrastructure.*** Social and physical infrastructure in the project area is, like in most rural areas in the country, poor. There are about 26 elementary schools and one high school in the project area. Six health stations and two health clinics also serve the population of the project area. Being malaria infested areas, these clinics are playing important role in the prevention and treatment of malaria. Dinking water supply availability is poor in quantity and quality. People have to walk long distances to fetch water.

II.24. Apart from a small limestone quarry, there are no industrial activities in the area and off–farm employment opportunities are very limited. The employment power of the small–scale irrigation schemes is also limited. There is no electricity in the rural area and there are few access roads. The area is, however, easily accessible through major road networks such as the Dekemhare – Mai–Aini – Tsorona Road, Mendefera–Kinaffna–Mereb Bridge, Mai–Aini – Hadida – Segeniti. Market places are generally located in the open or on roadsides, particularly for livestock.

II.25. The main local institutions are the village assembly or *baitos*. They are old institutions based on democratic principles that enable local populations to elect their own officials. The subject dealt with by the *baitos* comprises land administration including the distribution of agricultural land to its

members and the management of ranges and forestlands. They are important vehicles for people's participation in local development matters.

II.26. The closest government institution is the Kebabi administrative village and the Zoba desk office that replaced the former Subzoba structure of the local government. There are also staffs of line ministries in Mai–Aini and Tserona including agricultural extension staff that work closely with the farmers.

III. PROJECT RATIONALE

III.1. From the outset, the Government of Eritrea has placed high priority on agricultural and rural development in order to improve the livelihoods of the population at large. To this end, significant budgetary resources were directed to the rural areas through the *Ministry of Agriculture* (MoA) and other ministries that are involved in the development of social and physical infrastructure. In addition to sizeable investments made to increase crop and livestock production, major efforts were made in improving the degraded environment by mobilizing the people to carry out soil and water conservation works. Currently, the main development objective of the country is to reduce poverty, and agriculture is expected to play an important role in meeting that objective. In this context, MoA has been preparing its development strategy to enhance the achievement of the poverty reduction programme. One of the development options pursued by MoA now is to focus investments in major valley–bottoms of the country, which have high potential for development, such as the Hazemo Plains. The intention is to make such high potential areas pivotal development centres by adopting an integrated development approach that tackles the difficulties faced in the agricultural lands and in the catchment areas in order to facilitate their sustainable utilization.

III.2. In the past, the Hazemo plains were highly productive agricultural areas and there is no reason why their productivity cannot be revived with the introduction of appropriate technology and other essential support. The productive capacity of the plains could be restored, to greater extent, if the two major constraints prevailing in the area are addressed properly: i.e., the issues related to moisture or water control and to environmental degradation. The traditional farming systems practiced in the area have not succeeded in dealing with these two major constraints, and are on the verge of collapse. The failure to cope with climatic and environment changes is further aggravated by the *diessa* land tenure system as it discourages long–term investments on land. Therefore, any development programme in the area has to tackle these constraints if it has to become sustainable.

III.3. Given the constraints and difficulties mentioned, the development of the Hazemo plains appears to call for a comprehensive approach where the plains and the surrounding catchment areas are dealt with simultaneously. It should be recognized that the catchment areas are an important part of the plains and should be protected in order to serve better the plains down stream. Otherwise, the denuded catchment areas will continue to affect the plains negatively by releasing strong flashes of water, whenever it rains, aggravating soil erosion. Any development programme should, therefore, tackle the degraded catchment areas by carrying out soil and water conservation activities through civil works and vegetation cover, if long lasting development is to emerge.

III.4. With regard to agricultural development in the plains, future programmes should aim at minimizing the effect of rain shortage by adopting suitable technologies that can resist drought, e.g. the use of drought resistant varieties, and conserve moisture in the soils for a longer period of time. Needless to say, such technologies should be complemented with the supply of the necessary inputs to achieve improved productivity. In addition, the traditional livestock production system should be

supported through improved range management, supply of drinking water, supplementary feeding with high value feed and provision of adequate animal health services. Improving the areas infrastructure base would also be required to facilitate access to production areas and markets.

III.5. Parallel to improved rainfed farming, there is a need to expand irrigated agriculture in the area wherever feasible. Opportunities for irrigation development in the area are believed to be good, both from under ground and surface water resources, particularly for horticulture and fodder production. Given the proximity of Hazemo to Asmara and Masswa, market availability should not pose a problem. Lessons should be learned from the existing small–scale irrigation schemes in order to benefit from their experience. In this endeavour, due attention should be given to the land tenure systems and to possible environmental consequences of irrigation, such as on public health.

IV. PROJECT OBJECTIVES

IV.1. The project would have two ***major objectives***:

- to increase agricultural productivity and production of both crops and livestock by improving farming practices through the provision of new and improved inputs, better livestock management practices and improving the infrastructure base, particularly access roads; and

- to arrest and improve the deterioration of the environment by carrying out water and soil conservation techniques, including reforestation, by the communities.

IV.2. By working with the communities in a participatory manner, the project would strengthen community organizations. It would also create employment, thus enabling the local communities to increase their incomes. In addition, by implementing the first development phase of the Hazemo plains, the project would function as a learning ground for generating information that could prove useful for the development planning of the rest of the Hazemo plains.

V. PROJECT DESCRIPTION

V.1. The project would aim primarily to raise the productivity and production of agricultural products whose marketability has been ascertained (horticultural crops and small stock) by developing small–scale irrigation through the construction of small dams and shallow wells, water harvesting, and undertaking associated soil conservation measures in selected catchment areas. The project would also provide funding for the development of essential agricultural services (such as extension, credit, marketing and animal health) and social infrastructure (access roads and water supply — for both human and livestock). In the process, it would contribute to minimizing the risks associated with the present farming systems in the project area of rainfed crop production and extensive livestock rearing which are increasingly being seriously affected by more frequent droughts. In particular, the project would provide funding and other required assistance (such as technical support) for:

- the construction of small–scale water harvesting and water conservation structures and dug–out wells, along with appropriate soil conservation measures, in specific areas of the Hazemo Plains preselected for their technical and environmental feasibility;

- the introduction of appropriate small–scale irrigation and water management systems, from both surface and underground water sources, that would ensure long term

sustainability and minimize risks associated with irrigated farming such as silting, salinity and other drainage problems;

- increasing and intensifying the production of high–valued horticultural crops, suited to the project area and with a sure market outlet (such as Decamare and Asmara);
- promoting and expanding the integration of crop and livestock production (in particular of small stock) by controlling and improving grazing areas, such as through the provision of watering points in strategically selected locations; and in addition, improving livestock production through better animal health services, the introduction of new breeds along with appropriate management systems, and improving their nutrition through supplemental fodder production;
- intensifying existing essential agricultural services such as research on crop and livestock husbandry, irrigation systems, soil and water conservation practices, (in collaboration with the *National Agricultural Research Institute*, NARI) and expanding services in agricultural extension, credit and marketing;
- construction of social infrastructure facilities identified as priority by the project area communities, such as access roads and water supply, and working out arrangements for their long–term maintenance by the beneficiary communities with minimum government support; and
- strengthening community and *zoba*–level institutional capacity for the execution and monitoring of the different project activities, and providing on–the–job training that would ensure the sustenance of the results (or outputs) of the different development activities carried out under the project.

V.2. ***Irrigation and Development.*** The project will support the expansion of irrigated agriculture in the project area by constructing a medium size dam across Finkika stream with a conveyance facility and on farm irrigation structures and permanent diversion structure for spate irrigation across Hames. By constructing these two structures 8.5 million cubic metres of water can be stored and used for year round irrigation of 850 ha of land in the Agula–Zerto valley and for irrigated cereal production of about 400 ha at Mai Wuray (Hames). To increase ground storage and enhance recharge, a number of sand storage and subsurface dams will be constructed at appropriate sites. In areas where existing ground water storage and rate of recharge is higher than the present extraction, the project will support farmers to dig wells and use pumps to irrigate valuable horticultural crops. Along with this intervention, a groundwater management system will be setup for sustainable use of the resources.

V.3. ***Drinking Water Supply.*** Seven villages within the project area are identified as having a critical problem accessing drinking water both for human and livestock. To solve this problem the project will construct a total of seven boreholes with complete community water supply distribution systems.

V.4. ***Soil and Water Conservation.*** In order to minimize the sedimentation rate of the proposed Finkika reservoir and irrigation facilities below the Hames diversion, constructing hillside soil and stone bund terraces, check dams and tree planting, will protect the upper catchments of both sites. Additional soil conservation activities like farmland terracing and riverbank training and protection will be undertaken to protect farmland losses within the irrigated and rain–fed agriculture fields and grazing lands. These will be achieved by: (a) constructing 2,200 km of hill side terraces, (b) constructing 420 check dams to control gully erosions; and (c) promoting the afforestation of 5,600 ha through planting of multi purpose trees in the upper catchment of Finkika, Hames and Chealo–

Hadadim. Three nurseries (Agula–Zerto, Hames and Chealo–Hadadim) will be established for tree seedlings and forage legumes.

V.5. ***Crop Production.*** The major aim of the project is to increase crop production through intensive systems per unit area. This could be achieved through horticultural production under irrigation. The mode of production under the project will be to provide 1 to 2 ha of land per household that can be used for integrated crop and livestock production. About 50 percent of the households will produce vegetable and the remaining 50 percent will grow citrus fruits. Vegetables will be produced twice a year.

V.6. Through the project funds for well digging, pumps, pipes, seed, fertilizer, pesticide and farm tools will be available at the initial stage of the project to maximize horticultural production. Water harvesting techniques such as spate irrigation will be developed as a supplement to rainfall.

V.7. ***Livestock Production.*** The principle to improve livestock production in the project area would be by modifying the present extensive model so that it becomes more intensive. The two strategies, depending on the AE characteristics of the specific site, include diversification, integrating livestock with cropping and in particular the irrigated type or developing potential grazing land. The main aim is to ensure feed and water supply availability throughout the year; upgrade and improve animal breeds, and improve management and health. In the modified model, crop and livestock will complement each other (e.g. feed, manure). Through diversification, target groups such as female–headed households will be involved (e.g. poultry, small stock) and income will be generated throughout the year. The value of livestock according to herd size will is replaced by the higher financial unit value of the animals.

V.8. In the project area, sites 1 and 3 have potential for crop irrigated and the livestock model to be integrated would consist of small flocks of goat and backyard poultry under semi–intensive system because both species are very efficient procedures. Site 2 will be developed for the production of improved beef cattle and meat goat.

V.9. The approach in sites 1 and 3 will involve provision of initial breeding stock and forage/fodder seed and veterinary supplies. In site 2, it will involve grazing land development; construction of water points; and construction of veterinary and marketing infrastructure.

V.10. The present production model will be upgraded so that both become complementary to each other. It will consist of goats (10 does) and poultry (20 layers) per household under irrigated crop production. The goat and poultry production model will produce adequate cash income and household nutrition will be improved. The project will involve provision of initial breeding stock, forage/fodder seeds and veterinary supplies as well as establishing perennial pasture and legume fodder trees.

V.11. Site 2. The project approach in Site 2 would support intensification of the existing extensive cattle and goat production models through improved nutrition, health, and management. It will involve development of about 12,000 ha of natural pasture; constructing water points; establishing veterinary infrastructure; restocking; forage conservation; paddocking to control grazing; and establishing market facilities. It will consist of about 6,000 breeding cattle and 12,000 breeding goats.

V.12. Site 4. The area is about 7,800 ha and the present land use is grazing during the dry season and drought years where cattle come from very far villages. The approach will consist of grazing land development (reseeding); soil/water conservation; construction of water points; paddocking to control grazing and construction of veterinary infrastructure.

V.13. ***Socio–economic Infrastructure.*** This component will deal with the: (a) development of access to markets; (b) services to farm equipment (c) access to finance; (d) and access to drinking water for the population.

V.14. ***Extension.*** The project will support the extension system in disseminating information and giving advice to farmers and CBOs on matters technical, economic, marketing and finance.

V.15. ***Institutional Base.*** The component will deal with strengthening capacity of the various stakeholders of the project area involving: (a) establishing organizations at community level to manage their duties such as water, grazing and marketing committees; (b) management systems; (c) training of farmers and extension staff; and (d) marketing and financing operations.

V.16. ***Project Coordination.*** A project coordination unit will be established to ensure efficient implementation of the project. It will coordinate the activities of the various partners involved in project implementation. The unit will be responsible for preparing *Annual Work Plans and Budgets* (AWPBs) and monitoring and evaluation.

VI. INDICATIVE PROJECT COSTS

VI.1. The investment costs given are only indicative and are presented by component in Table 5. The major costs were based on domestic price quotations. For costing of the irrigation infrastructure and wells local standards have been taken as a guide, as there are many similar projects in the country. It was assumed that imported materials would not be subject to import taxes and that prices of the domestically produced items would be stabilized. It is also assumed that the government is committed to contribute 10 percent of its share for Agriculture. The costs of labour provided by the beneficiaries were based on current domestic prices for labour.

Table 5: Cost Summary per Component

Component	Local	Foreign	Total (US$)	% Foreign Exchange	% of Total Base Cost
Irrigation Development	1,418,180	5,580,270	6,998,450	79.7%	38.5%
Drinking Water Supply Development	122,500	509,800	632,300	80.6%	3.5%
Soil Conservation	867,440	545,600	1,413,040	38.6%	7.8%
Horticulture Development	48,000	829,830	877,830	94.5%	4.8%
Livestock Development	78,000	5,559,000	5,637,000	98.6%	31.0%
Socio–economic Infrastructure	62,250	1,049,750	1,112,000	94.4%	6.1%
Research and Expenditure	50,000	150,000	200,000	75.0%	1.1%
Institutional Support	200,000	300,000	500,000	60.0%	2.8%
Project Management	200,000	300,000	500,000	60.0%	2.8%
Technical Assistance	–	300,000	300,000	100.0%	1.7%
Total Base Cost	3,046,370	15,124,250	18,170,620	83.2%	100.0%
Physical Contingency	152,218	756,212	908,530	83.2%	5.0%
Price Contingency	304,637	1,512,425	1,817,062	83.2%	10.0%
Total Project Cost (US$)	3,503,325	17,392,887	20,896,212	83.2%	115.0%
Investment Cost per Beneficiary HH (direct + indirect = 16,605 HH)			*1,258*		

VII. PROPOSED SOURCES OF FINANCING

VII.1. The major investment for irrigation development, soil and water conservation, social infrastructure, and crop and livestock development would require external funding for the purchase of essential equipment, material and technical assistance. Government would provide counterpart funding for expenditures that would not require foreign exchange. The beneficiary communities would contribute labour and local materials for the construction of labour–intensive civil works, such as irrigation systems and erosion control structures and feeder roads. External sources of financing (either bilateral, multilateral, or both) would also be required, particularly for costs requiring foreign exchange.

VIII. PROJECT BENEFITS

VIII.1. The main benefits that would to result from the project include higher income, and hence improved livelihoods and nutritional status, of the target population and amelioration in soil fertility and the natural resources base of the project area. Specifically:

- the productivity and production of crops and livestock would be improved, which would consequently lead to higher yields and better farmer income and improved living conditions;
- particular target groups, including demobilized soldiers, internally displaced persons (IDPs), and refugees returning from neighbouring countries would benefit from their resettlement and the assistance they are provided within the form of sustainable livelihoods based on crop and livestock production;
- as the project area is potentially a surplus producer, there would be surplus production of crops and livestock for marketing outside of the project area;
- the soil and water conservation measures would lead to an improvement of the natural resources base of the project area through reduced degradation and improved fertility of the soils; and
- there would be an improvement in the capacity of local and Zoba–level institutions in the design, implementation and monitoring of development programmes.

VIII.2. ***One–Year Farm Budget for Tomato.*** The following farm budget was prepared for tomatoes under the assumption of two harvests per year. Cost calculations were made for one hectare of land taking into account information gathered during discussions with farmers and also experts estimation of input costs and returns from tomato production in that specific area. Market conditions for tomatoes were also considered for purposes of safety margin in pricing and the perishable nature of the product.

VIII.3. At present average tomato yield per hectare is assumed to be 80 quintals. The project is expected to raise the yield to 120 quintals per hectare under favourable conditions and there will be a 50 percent increase in yield. The current productivity level and output per hectare is considered to be very low. Although the crop budget indicates high potential for profits, a detailed economic and financial analysis of the project should be undertaken.

Table 6: Tomato Crop Model – 1.0 ha	
Item	(US$)
Fixed Costs	
Cost of wells	89
Cost of pumps	180
Cost of pipes	6
Cost of farm tools	10
Total Fixed Costs	285
Variable Costs	
Cost of seed	74
Cost of fertilizer	132
Cost of pesticides	296
Cost of oxen power	122
Cost of labour	1,786
Fuel and Lubrication	274
Transport costs	650
Cost of stick	111
Total variable Costs	3,445
Total Expenditure	3,730
Returns	
Expected income from tomato (120 quintals @ US$30 x 2) =	7,200
Gross Profit	3,470

IX. IMPLEMENTATION ARRANGEMENTS

IX.1. The project will be implemented within the framework of the concerned government agencies using the existing government institutional arrangements as much as possible. It will involve several partners; hence it will require maximum coordination. For this purpose, it will be provided with an efficient coordinating unit. A steering committee will be formed from among the partners with the function of overseeing that project implementation is within the planned time and budget framework. The main partners will be the regional administration, the MoA and the CBOs. The coordinating unit will be responsible for routine activities such as financial management, monitoring and evaluation and preparing AWPBs. It will be responsible to the steering committee. The beneficiary committee will form CBOs for the various project functions by establishing committees. The CBOs will participate in planning, deciding, implementing and monitoring and evaluation functions. The specific roles and responsibilities of the different ministries and the local government and other parties involved in project implementation and its monitoring will be clarified and defined more precisely at the time of project preparation.

X. TECHNICAL ASSISTANCE

X.1. Implementation of the project would require both short and long term technical assistance. Although the length and specificity would require farther detailed work, the following areas are likely to be where technical assistance would be needed:

- irrigation engineering and irrigation agronomy;
- livestock production and health;

- horticultural crops production, handling and marketing;
- soil and water conservation;
- research and extension, covering rainfed and irrigated crops and livestock.

XI. ISSUES AND PROPOSED ACTIONS

XI.1. There are a number of issues that require further clarification prior to finalization of the project:

- ***Scarcity of Farm Labour.*** This is an evolving problem, particularly for livestock as more and more children attend school and are unavailable for on–farm activities.
- ***Soil and Water Conservation.*** On the bases of a careful review of past experience, and taking into account the specific characteristics of the project area, a decision should be made on the suitability of methods of soil and water conservation measures to be adopted under the project.
- ***Environmental Impact Assessment.*** Some of the proposed project interventions, such as the construction of small dams and diversion structures are likely to have some negative impact on down stream areas. The extent of the negative impact would have to be known and mitigating measures would have to be identified before proceeding with detailed preparation.

  In general the water development project activities proposed for implementation as part of the HPIDP are aimed at rehabilitating the deteriorating environment of the project area. However, there are health concerns like a potential increase in the cases of malaria due to the proximity of the large area of water to villages and these and other environmental concerns has to be evaluated and their mitigation measures should be proposed during the detailed project planning stage.

  The overall EIA for the project should be undertaken during the feasibility stage. At this project formulation stage there are no significant environmental and water right issues that could be considered as risks for the implementation of these projects.
- ***Land tenure.*** Rules and regulations on land tenure and land use will have to be clarified before any investment can be contemplated, particularly as regards irrigation development and soil conservation.
- ***Institutional decentralization.*** The specific roles and responsibilities of the Zoba and Sub–Zoba administration and representatives of line ministries will need to be clarified before designing the implementation arrangements of the project and its specific components.
- ***Community participation.*** Mechanisms that would ensure effective participation of the beneficiary communities, both in terms of their direct contribution to the major investments (such as irrigation infrastructure and soil conservation measures) and on their on–farm development activities, would have to be worked out in consultation with the concerned communities.

XII. POSSIBLE RISKS

XII.1. Possible risks that may negatively affect project implementation include:

- ***Staffing.*** Shortage of qualified staff, both from the local administration system and the line ministries, may affect project implementation quantitatively and qualitatively, resulting in delays and poor quality of outputs.

- ***Government Regulations and Procedures.*** There could be serious delays in project implementation due to inflexible procurement and other procedures, as well as due to cumbersome decision making processes of government offices involved in project implementation, directly or indirectly.

- ***Government Counterpart Funding.*** Irregular and delayed release of counterpart funds could negatively affect project implementation and outputs.

- ***Land Tenure.*** Continuation of the existing dual land tenure system may allow processing project implementation due to the dissatisfaction of local communities for lack of long–term lease hold. In addition, people who cultivate land with irrigation potential may not invest in irrigation development if their tenure is *diesa*–based.

XII.2. The potential risks are flagged above with the view to draw the attention of the concerned policy makers. It is expected that clear mitigation measures will be prepared during project formulation.

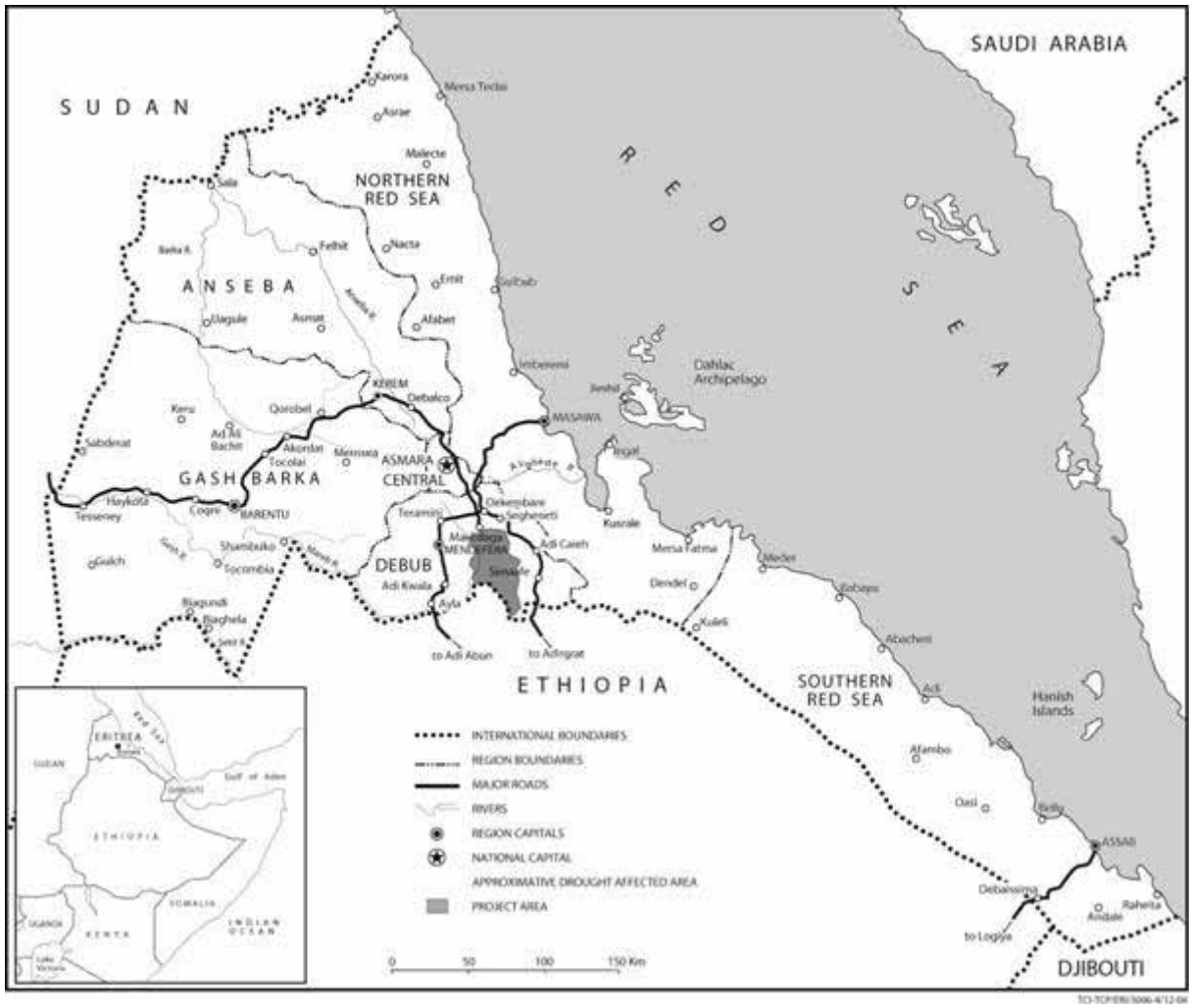
ANNEXES:

Annex 1: Map of Eritrea Showing the Location of the Project Area

Annex 2: Livestock Component Indicative Financial Returns by Project Site

Annex 3: Production Cost of Some Crops Used to Calculate the Financial Results

Annex 1: Map of Eritrea Showing the Location of the Project Area



Annex 2: Livestock Component Indicative Financial Returns by Project Site

Sites 1, 3, and 7 (Agula–Sebene–Tserona)

Site	1	3	7	Total
HH (direct beneficiaries)	600	686	300	1,586

Goat and Backyard Poultry Production Mode (20 Does + 25 Layer Hens/HH)

(a) Goat Model

Production Coefficients	
Parameter	Value
Breeding does (Nº)	20
Breeding buck (Nº)	2
Fertility rate (%)	90
Kid/doe/year (Nº)	2
Kid mortality/year (%)	2
Adult mortality/year (%)	0.8
Milk yield/doe/day (kg)	1.3
Lactation period length (day)	90
Total lactation length (day)/year	162
Replacement rate, doe (%)	15
Twining rate (%)	20

Farm Budget				
	Unit	Qty.	Value (Nakfa)	
			Unit	Total
Income:				
Milk @ 1.0 kg/day/doe = 162 kg/year 18 does @ 162 days lactation period after kid feeding = 2,916 kg/year @ 1 kg/day/home consumed = (–) 365 kg @ Net for sale 2,551 kg/year	kg	2,551	6.5	16,581.5
Breeding goat (yearlings) @ 12/year after replacement	Nº	12	650	7,800
Meat:				
14 bucks @ 32 kg lbw each/year	Nº	14	600	8,400
3 cull does/year	Nº	3	500	1,500
Manure	t	2	600	1,200
Total Income				35,481.5
Expenses:				
Feed				
Roughage PM	t	14	3,000	4,200
Supplement	t	0.5	10,000	5,000
Veterinary	Nº	365	25	9,125
Labour (family)	person–day	40	25	1,000
Miscellaneous				3,000
Total Expenses				22,325.5
Profit (before tax)				13,156.5

(b) Backyard Poultry Model (Scavenging + Supplement)

Production Coefficients	
Parameter	Value
Layer (Nº)	25
Cock (Nº)	3
Age egg laying point (month)	6
Laying period length (month)	12
Egg mass weight (g)	45
Total conc. Feed from chick to laying point/pullet (kg)	7.2
Total feed consumed/hen/year	21.9
Egg laying/year/hen	200
Hen mortality rate/year (%)	8
Liveweight/hen (kg)	1.2

Farm Budget				
	Unit	Qty.	Value (Nakfa)	
			Unit	Total
Income:				
Egg sale	Nº	5,000	1.3	6,500
Spent hen	Nº	23	90	2,070
Total Income				8,570
Expenses:				
Feed cereal grain (conc.)	kg	727.5	4	2,910
Labour (family) @ 1½ hrs/day = 548 hrs/year	person–hour	548	1.5	822
Veterinary				350
Transport (share community)				500
Pullet for replacement (home brood)	Nº	30	15	450
Miscellaneous				600
Total Expenses				5,632
Profit (before tax)				2,938

Project Area Total Annual Financial Result (3 Sites)

Total HH	1,586
Total return/HH (Nakfa)	2,938 + 13,156.5 = 16,094
Total annual financial return of project area (Nakfa)	25,525,084

Site 2: Middle Mereb River

Grazing land (ha): 14,000; Breeding cows: 8,000; Breeding does: 12,000

Production Coefficients			
Parameter	Value	Parameter	Value
Cattle		Goat	
Breeding cow (Nº)	8,000	Breeding does (Nº)	20
Age first calving (month)	33	Breeding buck (Nº)	2
Calving interval (month)	12	Fertility rate (%)	90
Fertility rate (%)	75	Kid/doe/year (Nº)	1.8
Cow productive life (year)	9	Kid mortality/year (%)	2
Claves/cow/productive life (Nº)	8	Adult mortality/year (%)	0.8
Calf mortality/year up to mortality (%)	3	Milk yield/doe/day (kg)	1.3
Adult mortality/year (%)	2	Lactation period length (day)	90
Milk yield/cow/day (kg)	4	Total lactation length year @ 1.8 kid/year/day	162
Lactation period length (day)	240	Doe replacement rate (%)	15
Steer liveweight at slaughter age (kg)	210	Twining rate (%)	20
		Liveweight at slaughter age (kg)	30

Farm Budget (HH)				
	Unit	Qty.	Value (Nakfa)	
			Unit	Total
Income:				
Cattle				
Meat (lbw basis)				
Steer: 2,900 steer/year production @ 400 kg lbw each	t	1,160	30,000	34,800,000
Cull cow: 1,200 cows @ 360 kg lbw	t	360	25,000	9,000,000
Milk: yield 4 kg/cow/day after calf feeding @ 210 days lactation period length @ milking 5,000 cows = 4,200 t/year	t	4,200	4,000	16,800,000
Subtotal Cattle				*60,600,000*
Goats				
Meat (lbw basis)	t	525	20,000	10,500,000
Milk	t	875	4,000	3,500,000
Subtotal Goats				*14,000,000*
Total Income				74,600,000
Expenses:				
Pasture maintenance	ha	14,000	2,000	28,000,000
Feed conservation	t	15,000	200	3,000,000
Water system maintenance				2,000,000
Feed supplement	t	492	5,000	2,460,000
Veterinary				2,500,000
Buildings maintenance				1,600,000
Equipment maintenance				3,000,000
Labour	person–year	220	18,000	3,960,000
Transport				1,200,000
Total Expenses				47,720,000
Profit (before tax)				26,880,000

Project Area Total Annual Financial Result

Total annual financial result of project area: 26,88,000 Nakfa.

Site 4:

50% of site ha: 27,000 ha; cows: 4,000; goats: 12,000; grazing land area: 7,000 ha.

Production Coefficients			
Parameter	Value	Parameter	Value
Cattle		Goat	
Breeding cow (No)	8,000	Breeding does (No)	20
Age first calving (month)	33	Breeding buck (No)	2
Calving interval (month)	12	Fertility rate (%)	90
Fertility rate (%)	75	Kid/doe/year (No)	1.8
Cow productive life (year)	9	Kid mortality/year (%)	2
Claves/cow/productive life (No)	8	Adult mortality/year (%)	0.8
Calf mortality/year up to mortality (%)	3	Milk yield/doe/day (kg)	1.3
Adult mortality/year (%)	2	Lactation period length (day)	90
Milk yield/cow/day (kg)	4	Total lactation length year @ 1.8 kid/year/day	162
Lactation period length (day)	240	Doe replacement rate, (%)	15
Steer liveweight at slaughter age (kg)	210	Twining rate (%)	20
		Liveweight at slaughter age (kg)	30

Farm Budget (HH)				
	Unit	Qty.	Value (Nakfa)	
			Unit	Total
Income:				
Cattle				
Meat (lbw basis)				
Steer: 1,400 steer/year production @ 400 kg lbw each	t	560	30,000	16,800,000
Cull cow: 600 cows @ 360 kg lbw	t	216	25,000	5,400,000
Milk: yield 4 kg/cow/day after calf feeding @ 210 days lactation period length @ milking 2,600 cows = 2,184 t/year	t	2,184	4,000	8,736,000
Subtotal Cattle				*30,936,000*
Goats				
Meat (lbw basis)	t	346	20,000	6,920,000
Milk	t	570	4,000	2,280,000
Subtotal Goats				*9,200,000*
Total Income				40,136,000
Expenses:				
Pasture maintenance	ha	7,000	2,000	14,000,000
Feed conservation	t	7,000	200	1,400,000
Water system maintenance				1,000,000
Feed supplement	t	300	5,000	1,500,000
Veterinary				1,500,000
Buildings maintenance				800,000
Equipment maintenance				1,200,000
Labour	person–year	110	18,000	1,980,000
Transport				400,000
Miscellaneous				2,000,000
Total Expenses				25,780,000
Profit (before tax)				21,644,000

Project Area Total Annual Financial Result

Total annual financial return for project area	21,644,000 Nakfa
Return per ha	4,683 Nakfa

ASSUMPTIONS:

- *The prices of outputs taken to estimate the indicative financial results were about 30% lower than the actual prices in Eritrea during the last quarter.*
- *The prices of inputs taken were those of the years before the Eritro–Ethiopian war (1997) because current prices are too inflated to be representative.*
- *It is assumed that input and output price increases will balance with each other.*
- *The production coefficients given were based on wide experience in Eritrea comparing the typical traditional system with those improved systems. In effect, about 20% safety margin has been given in most cases.*
- *Exchange rate: 1.00 US$ = 19.00 Nakfa.*

Annex 3: Production Cost of Some Crops Used to Calculate the Financial Results

Cost of Production for Sorghum				
Item	Unit	Qty.	Cost (Nakfa)	
			Unit	Total
Seed cost	kg	10	10	100
Ploughing	oxen day	8	80	640
Seeding	oxen day	4	80	320
Fertilizer	quintal	1	250	250
Weeding	person–day	15	50	750
Harvesting labour	person–day	15	50	750
Transport to market	quintal (100 kg)	18	40	720
Total costs				3,530
Yield per hectare	quintal	18	500	9,000
Net benefit per ha				5,470

Cost of Production for Tomato				
Item	Unit	Qty.	Cost (Nakfa)	
			Unit	Total
Seed cost	kg	0.5	1,000	500
Seedling				
Seed bed prep. for seedling	person–day	2	50	100
Irrigation	person–day	5	50	250
Weeding	person–day	2	50	100
Land preparation (Ploughing)	oxen days	9	80	720
Fertilizer DAP	quintal	2	250	500
Urea	quintal	2	200	400
Transplanting	person–day	30	50	1,500
Irrigation				
Fuel	litre	180	10	1,800
Oil	kg	2	30	60
Labour (irrigation)	person–day	90	50	4,500
Cultivation	person–day	20	50	1,500
Weeding	person–day	30	50	1,500
Staking				
Stick for standing of tomato				1,500
Labour for sticking	person–day	15	50	750
Pesticide				
Insecticide	litre	6	200	1,200
Fungicide	litre	4	200	800
Harvesting labour	person–day	40	50	2,000
Transport to market	quintal	110	40	4,400
Total costs				24,080
Yield per hectare	quintal	110	400	42,800
Net benefit per ha				19,920