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 IV of V

BANKABLE INVESTMENT PROJECT PROFILE

Tsilima 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)

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NEPAD–CAADP BANKABLE INVESTMENT PROJECT PROFILE

Country: Eritrea

Sector of Activities: Agriculture

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

Project Area: Debub Administrative Region

Duration of Project: Five years

Estimated Cost: Foreign Exchange.....US$16.80 million
Local Cost.....US$3.32 million
Total..... US$20.12 million

Suggested Financing:

Source	***US$ million***	***% of total***
Government	2.02	10
Financing institution(s)	16.83	84
Beneficiaries	1.27	6
Private sector	–	–
Total	***20.12***	***100***

ERITREA:

NEPAD–CAADP Bankable Investment Project Profile

"Tsilima Plains Integrated Development Project"

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Abbreviations

ADB	African Development Bank
AWPB	Annual Work Plan and Budget
BIPPs	Bankable Investment Project Profiles
CAADP	Comprehensive Africa Agricultural Development Programme
CBO	Community–Based Organization
EIA	Environmental Impact Assessment
FAO	Food and Agricultural Organization of the United Nations
GDP	Gross Domestic Product
HH	Households
IFS	Integrated Farming Schemes
MoA	Ministry of Agriculture
NEPAD	New Partnership for Africa's Development
NGO	Non–Governmental Organization
NMTIP	National Medium–Term Investment Programmes
TPIDP–1	Tsilima Plains Development Project – Phase 1

I. PROJECT BACKGROUND

A. Project Origin

I.1. The above 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* (NMTIPs), and a set of *Bankable Investment Project Profiles* (BIPPs).

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 *Tsilima Plains Development Project* (TPIDP–1) 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 well suited to produce a wide variety of tropical and temperate crops.

I.4. Although the bulk of the population lives in the rural areas, agricultural contribution to GDP is relatively modest, accounting for only about 12 percent in recent years. 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 being 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 many farmers have been displaced and production systems disrupted. The country is dependent on the outside world for food 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 the 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 project area is located in the Debub Administrative Region and more specifically in the former Debarwa Subregion (see map in Annex 1). In terms of agroecological zones, the area is part of the Central Highlands. Mereb River and its tributaries (Conceria, Halhali and Mai Mogoso River) form the main drainage system of the project area. The total landmass area is 27,400 ha of which 14,900 ha is the mountain range (upper catchment) and 12,500 ha of flat plain (lower catchment). The livelihood of the population is based on mixed crop and extensive livestock production where cropping is of high intensity, but this equilibrium has been already altered in favour of crop production leading to changes in livelihoods. The area is one of the most densely populated parts in Eritrea.

II.2. The project area, being relatively of high rainfall and fertile soils, is one of the main crop producers in the country and it ranks among the first in the Debub Administrative Region. It is located near the Asmara peri–urban area and, as a result, is being influenced by high demands to produce more high value foods. Although rainfed cereal production is still the main activity, semi–intensive irrigated horticulture and livestock systems are also emerging as the demand for expensive foods in urban areas grows. This is changing the attitude of the farmers towards improved agricultural production system towards a greater market orientation. The project area is therefore of high potential to increase food production, in particular vegetables and milk. The main constraints are inadequate irrigation water due to the absence of proper water management and poor production systems.

II.3. ***Location Land and Population.*** The project area of the TPIDP–1 is shown in the Location Map. The Tsilima plain is bounded on the east and northeast by the Mereb River, on the south and southeast by Mai–Mogoso stream and gravel road that connects Tera–Emni with Dekemhare respectively and on the west and northwest by the foot of steep and rugged basaltic mountains that stretch between the villages of Adi Hizbay – Amadir – Adi Selayit. The total number of households, villages and the population in the project area are 13;613; 86; and 69;264 respectively. Out of the total potential project beneficiary households, 5,270 are direct beneficiaries from the project while the remaining 8,343 are indirect beneficiary households. The total indirect beneficiary population is estimated to be about 42,199 while the direct beneficiary population is around 27,065.

II.4. ***Physical Characteristics and Climate.*** The project area is generally flat with gentle inclination of about 1.4 percent from northwest to southeast. The altitude of the plain ranges between 1,800 and 2,000 m a.s.l. while that of the upper catchment mountain ranges is 2,500 m. Soil types are clay, clay loam and sandy loam with an average depth of 0.5 m near the foot of the hills and to 3 m in the middle of the plain. Soil erosion is rather heavy in the denuded upper catchments and the plain. Small streams show river bank soil erosion and farmland also suffers also from surface erosion as demonstrated by the formation of guidelines. As a result, soil fertility has declined in many areas.

II.5. The climate is subtropical with average mean annual temperature of about 17ºC. The coldest months are December and January with an average temperature of 5.8ºC while the hottest months are April and May when the average temperature is around 28ºC. The rainfall pattern is similar to that of the central highland, which is characterized by poor distribution and erratic intensity leading to frequent droughts and crop failures. The average annual rainfall is about 658 mm. As an illustration of the extreme variability of annual rainfall it is enough to indicate that the annual rainfall in 2000 amounted to only 342 mm, while that for 1996 was 855 mm. Due to this variability of rainfall, the traditional crop–livestock balance has been altered in favour of cropping, in particular horticulture which, in turn, is restricted by soil moisture deficiency.

II.6. ***Land Use and Land Tenure.*** About 9,500 ha or 76 percent of the Tsilima plain is arable land of which an average of 6,000 ha is cultivated annually. And from this about 400 ha is used for irrigated crop production. The agricultural system is traditionally mixed crop/livestock with high rainfed cropping intensity. Intensified agriculture, though at a low scale, is emerging.

II.7. In Eritrea, land is owned by the state and the land tenure in the project area is rotational. Farmers recognize the disadvantage of this tenure system, which is the practice in the Eritrean highlands. Given the periodic rotation of farm parcels, individual farmers have no incentive in making long–term investment on land and activities on land improvement and soil and water conservation are minimal.

II.8. To avoid loss of irrigated farm plots due to the rotational practice in land holding, the farmers engaged in irrigated horticultural production enter into share cropping of different forms with other farmers. The most common being the 50–50 share and the 25 to 75 percent share depending on the investment made and the arrangement made between the two parties.

II.9. ***Surface Water.*** In general the project area lies within the upper Mereb catchment and is drained by three small ephemeral rivers, namely Mereb, Halhale and Mai–Mogoso. Mereb River originates near mountain Tekera and drains all areas south of the laterite ridge that separates Mereb from Nefhi catchment and flows in a south–east direction to from the north east and east boundary of Tsilima plain. Along its course Mereb will be joined by a number of small streams, which originate from the upper, steep basaltic mountains west of the plain. All these streams and their tributaries flow

in the southeast direction and earlier cross or bound the Tsilima plain before joining Mereb River and entering into the Haren–Gedele valley. The three streams have a total catchment area of 404 km^2.

II.10. The total volume of mean annual run–off generated within the project area and its upper catchment and cross the Tsilima plain could amount to approximately 24 million m^3. Of this volume, the upper Mereb Water Supply Project, which is presently at a feasibility study stage and meant to secure water supply to the towns of Mendefere, Debarwa Dekemhare and Tera–Emni, is expected to utilize about 12.7 million m^3 flow of Mereb at Debarwa. If the volume and the amount of run–off interrupted by the existing small dams storage within the catchment is reduced, the remaining volume of annual run off that could be used for direct irrigation or for ground water recharge is about 11.3 million m^3.

II.11. ***Groundwater.*** The major groundwater aquifers in the Tsilima plain are the alluvial and colluvial deposits beneath the soil and the highly jointed and weathered tertiary basalts and associated strata found below the alluvial and colluvial deposits along the course of the streams. In most cases the unconsolidated alluviums are usually above the ground water table and therefore, the weathered basalt aquifer beneath the alluvium have significance in terms of groundwater storage, recharge and movement. Springs are common in the foot of northwest mountains.

II.12. Depth to ground water varies from less than 4 to 10 m depending the location and season. Presently on average a single well could irrigate about 1.1 ha which is mainly due to falling ground water levels and diminishing spring flows. About 365 productive hand dug wells with 404 pumps are in operation to irrigate about 407 ha of land within the plain. Credit available for well digging and pump purchase encourages farmers to expand horticulture within the plain.

II.13. Continued lowering of the groundwater level could mainly happen due to recurrent drought associated with unrestricted pumping that suggests that ground water utilization in the area has almost reached its optimal stage. The total volume of groundwater that could presently be available without further intervention to maximize recharge is estimated to be about 4.8 million cubic metres. This volume of water will be able to irrigate about 480 ha of the Tsilima plain, which shows that presently 85 percent of the available groundwater is pumped for horticulture development.

II.14. ***Domestic and Livestock Water Use.*** Water supplies for domestic purpose are generated primarily from communal dug wells within villages. In most villages wells are not well protected from contamination and have inadequate water during the dry season. There is no reported shortage of water for livestock.

II.15. ***Existing Irrigation Practice.*** Irrigation in Tsilima plain relies on groundwater pumped from shallow wells dug into alluvium and fracture basalt aquifers. Small centrifugal pumps located within a 6–metre suction depth, pump directly to an irrigation channel. Basin irrigation is the common irrigation system used in the plain. The average yield of wells is so low that the area that could be irrigated per well is only about 1 ha. Near foot hills where spring flow is dominant, wells could irrigate up to 1.5 ha while in the middle and south east parts of the plain it could only irrigate less than 0.5 ha.

II.16. ***Crop Production.*** The agricultural production system in the project area is of the mixed crop/livestock type. The nature of the soil parent material is Cambisols and Vertisol and the soil types are clay, clay loam and sandy loam. Crop production is mostly based on rainfall and the major cereal crops grown are, in descending order, barley, wheat, sorghum, teff, maize and African finger millet. Fava bean, lentil and chickpea are important pulses in the plain. Small scale irrigated vegetable production is practiced using hand dug wells. The unreliable rainfall is the major factor constraining crop production in the project area. Cropping relies heavily on animal power for land preparation,

transport and threshing but oxen are in low supply and expensive to maintain. Availability of inputs such as seed for vegetables, pesticides, fertilizer and improved varieties is usually inconsistent.

II.17. During the rainy season land area for vegetable production increases because of the increased water supply availability. However, during the driest months it is reduced by more than 60 percent due to a decrease in ground water levels.

II.18. ***Livestock Production.*** The livestock production systems in the project area are extensive and semi–intensive systems, of which the first is most prevalent. The main animal species produced in the extensive system include indigenous sheep, goats and cattle. The estimated populations are 10,693 sheep; 8,661 goats and 13,445 cattle respectively. The semi–intensive system is small in size and it consists of dairy, fattening and poultry. The population of dairy cattle is 577 and the annual output of the fattening is about 680 heads of cattle.

II.19. The extensive livestock production system is part of the mixed crop and livestock farming system. Feeding is based on the use of marginal land for communal grazing, crop residue and aftermath grazing. Feed supply availability is in serious shortage and the quality is poor. The shortages are more acute during the dry season and drought years where the latter affects both the grazing land and the crop residue supply availability. The communal grazing area consists largely of rugged and rocky mountains with low density of vegetation cover. Thus, except for the short period during the wet season, the area has little or no value as a source of animal nutrients. The villages located in the central and eastern parts of the plain are without any marginal land for grazing and animals are kept in the homestead when the land is under crop. They survive mostly on hand feeding of crop residues with low nutrient value and digestibility. The feed supply availability is usually adequate only for body maintenance and the nutrient requirements for production (reproduction, growth, or milk) are insufficient for the most part of the year.

II.20. In the extensive system, some households usually own an average of about 2–3 cows or 4–8 goat/sheep each while many do not own livestock. Animals are herded by children and at times by the elderly, or by a hired shepherd to serve groups of households. However because children need to go to school, the elderly are incapable to take the animals to far grazing places, and hiring is expensive this arrangement is posing serious problems. Diseases and parasites are also major problems in the project area.

II.21. The semi–intensive system consists of the small scale commercial dairy, cattle fattening and poultry farms. This activity has grown recently due to the high demand of the urban population for livestock products. In this system, both dairy and cattle fattening are based mainly on by–product of flour–mills, crop residues and limited greens. However, feed supply from these sources is inconsistent and very extensive. The use of good quality roughage or hay is not practiced as many farms do not posses land for this purpose. The sources of mineral and protein nutrients and the feeding system are inadequate.

II.22. The productive and reproductive efficiency are low in both of the production systems of which the main production parameters are given in Table 1.

II.23. The primary constraints in current production practices include shortage of feed and poor feeding practices; high prevalence of diseases and parasites and poor management system. There are, however, good opportunities to increase food products of animal origin, particularly because the project area is part of the Asmara peri–urban zone with high demand for high value foods such as milk. The current production system of ruminant animals should be intensified by integrating it with

irrigated crops, basing feeding on good quality roughage and keeping fewer animals of high productive efficiency.

Table 1: Average Production Coefficient of the Present Production Model in the Extensive Livestock System

Parameter	Goat	Sheep	Cattle
Age at first kidding/lambing/calving (month)	18	20	48
Twinning rate (%)	10	8	–
Kidding/lambing/calving percentage	100	100	50
Kids/lambs/calves born per doe/ewe/cow per life time	6.6	6	8
Kid/lamb/calf mortality/year (%)	11	15	9
Kidding/lambing/calving interval (month)	11	12	24
Lactation period length (day)	90	–	160
Milk yield per lactation per doe/cow (litre)	20	–	260
Average flock size (No)	4	19	2
Age at slaughter weight (month)	20	19	52
Slaughter weight (kg)	18	26	200

II.24. ***Socio–economic Infrastructure.*** The project area is easily accessible and the road network tends to be good and services are relatively developed than in the other parts of the region.

II.25. The people of the project area have been historically involved in horticultural production in addition to cereal and livestock production. They produce vegetables such as potatoes, tomatoes, onions, garlic, etc. and there is the legacy of some Italian investors such as Conte Marassane, Paulino and others who had their concessionary farms in the area. The living standards of the farmers in the project area are relatively high. There are about ten female–headed households that have formed an association engaged in horticultural production. They market their produce through a farmers marketing association. All farmers in the project area are members of the marketing association and the aim is to protect the farmers from price exploitation by middlemen. The association owns a shop and has a storage facility and usually it sells the farm products to Debarwa and Asmara.

II.26. There are about eight primary schools and one junior secondary school. Secondary education is available in Debarwa, a rapidly expanding and developing urban centre of the project area. The area is relatively easily accessible and there is public (bus) transport to some of the villages from Debarwa.

II.27. Electricity power is available in some villages. The major diseases in the project area are Acute Respiratory Infection (ARI) and Pneumonia. There are two health stations providing services to the community employing five health assistants, one nurse and one midwife.

II.28. Credit system existed in the project area in the past for seeds, fertilizers and pumps. At present there is only a credit system for the purchases of water pumps. The ADB had a project in the area providing among other credit to support the farmers. Farmers get a loan of up to 15,000 Nakfa for digging a well. ACCORD is an NGO that was involved in credit provision and encouraging village banks in the area.

III. PROJECT RATIONALE

III.1. The opportunities to increase food production in the project area are high. The potential to increase crop and livestock production a sustainable basis is justified because the natural resources base (land, water supply for irrigation and climate) are favourable to intensify and diversify the existing traditional production models. The geographical location of the project area, being peri–urban, is quite favourable for markets because there is high demand for horticultural and food products of animal origin by the urban centres. The local level institutional arrangements e.g. village, local authority are well organized having village assemblies and committees with good capacity to manage their resources. It is equally favourable to note that the population recognizes very well the importance of market–oriented production as compared to the old attitude of subsistence based farming. The sustainability of the rainfed cropping and extensive livestock system is under heavy pressure from the recurrent droughts soil infertility and poor technology. As a result, the livelihood of the majority has been deteriorating.

III.2. The increasing demand for high value foods by the urban population has been a major factor to influence the attitude of the farmers. In effect, some farmers have already started to produce milk, meat and eggs under a semi–intensive system and irrigated vegetables. However, increased production is constrained by inadequate water supply and its management; poor production systems which lack integrated models, insecure land tenure, soil infertility, and lack of finance for investment. The water resources in the area need to be developed to allow irrigation of more land for increased horticulture and forage crop production but with strict water supply and demand control. Soil erosion should be effectively controlled and soil moisture increased. The livestock system requires intensification and the farming system should be integrated so that crop and livestock become complementary to each other and the market oriented production planning need to be supported.

IV. PROJECT OBJECTIVES

IV.1. The objectives of the project would be to:

- increase field crop production by conserving soil moisture and soil fertility through surface water spread at individual field level and controlling soil erosion at farm and upper catchment levels;
- increase irrigation water supply availability and introduce efficient water use management;
- increase crop production on a sustainable basis by increasing irrigation water supply through small–size dams construction and ground water recharging facilities;
- increase animal production on a sustainable basis by intensifying and diversifying the existing production models and by integrating them with cropping;
- establish essential economic infrastructure to provide support services;
- strengthen the institutional base at all levels to ensure availability of information technology, extension, finance, management of resources and marketing.

V. PROJECT DESCRIPTION

V.1. The project would consist of ***nine components*** to be implemented in five years.

V.2. ***Irrigation Development.*** In order to expand irrigated lands in the project area, small size dams will be constructed across the Kakebda–Adebzage and Emni Tselim streams. Using these dams a total of about 200 ha of additional land will be irrigated within the Tsilima plain. Conveyance, distribution and other associated structures will be constructed. External professional assistance will be provided for the design and supervision of both dams.

V.3. A series of long but short embankments mainly at the western end of the Tsilima plain across the streams where surface materials are more permeable and topographically suitable for the deposition of courser material will be constructed.

V.4. ***Drinking Water Supply.*** During this project phase a total of ten boreholes or protected dug wells will be constructed to supply clean water to ten villages within the project area, which have critical potable water shortage. Water will be delivered to the villages by transmission pipelines and distributed using distribution reservoirs and public fountains.

V.5. ***Soil Conservation.*** In association with the water development program for irrigation development, soil conservation measures would be undertaken with in the catchment areas of the dams. These would include construction of hill side terracing using earth and stone bunds; check dams across creeks and planting of multi purpose trees in the steep part of the catchments aimed at reducing siltation of the dams and controlling erosion. In order to stop further farmland losses by riverbank erosion additional soil–conservation measures like riverbank training and stabilization would be undertaken.

V.6. ***Crop Production.*** The project's approach would be to increase vegetable production in the project area by increasing the area of the land under irrigation and to select more high value crops. There is an opportunity to increase the area by about 200 ha with the construction of a dam at Kakebda and Amni–Tslim village.

V.7. This component will give support to horticultural development in the area with appropriate production models of integrated crop livestock. The model of the improved crop production will be on 2.0 ha of land of which 1 ha will be used for intensive vegetable production and the remaining 1 ha will be used for forage production. The project will establish vegetable seed multiplication sites to alleviate seed shortage in the area. In addition it will provide pesticide and fertilizer at the initial stage of the project. It will also support the provision of animal drawn cart (cart drawn by donkey) for transportation of produce from the farm to the nearest market. In addition, the project will provide periodic training on modern vegetable production and integrated pest management system to farmers. The project will also construct structures that will help to maintain moistures retention within farm lands.

V.8. ***Livestock Production.*** The project area has high potential for the production of milk and eggs for the market. The component will have two subcomponents: the dairy and poultry model and support to existing dairy farms. The project will focus on integrating small size dairy herds and backyard poultry with irrigated horticulture. The livestock model will be based on one ha of land as a source of irrigated forage crop, crop residue, weeds and small quantities of purchased supplements, with livestock housing located on the farmstead. The project will provide three breeding dairy cows and 25 layer birds per household. The approach will involve provision of initial breeding animals;

establishing irrigated forage/fodder crop production for cut and carry, construct simple animal sheds; and strengthen veterinary and market infrastructure.

V.9. The second approach would be to improve the forage feed supply availability to the existing small–scale commercial farms to enable them to produce forage under irrigation in an already identified field. The main elements of the approach include developing irrigated pasture land (30 ha); and providing machinery for hay preparation.

V.10. ***Socio–economic Infrastructure.*** To promote agricultural production, particularly horticultural as well as livestock production, in the area, it is important to improve the socio–economic infrastructure. This component will include:

- *Marketing System Improvement.* Under this component, the following activities will be carried out: support for existing farmers marketing associations, introduction of improved harvesting and out put handling techniques, introduction of grading and quality controls, provision of trucks for transportation and improvements in storage facilities as well as development of packaging materials using local materials as much as possible.

- *Access/Feeder Roads.* The project area is relatively accessible during the dry season but access roads to some villages are not functional during the rainy seasons. Under this component access roads will be constructed and improved using the labour intensive techniques to facilitate collection of horticultural products and improve the marketing of produce as well as the input delivery system in the area.

- *Credit System.* This component will include the provision of credit to the farmers marketing association for the purchase of truck (vehicle) as well as improve its shop and storage facilities.

- *Processing Plants.* Under the assumption that the project would promote incremental production, this component would support the establishment of small processing plants that are technically and cost effective, in particular for tomatoes and fruits.

- *Repair and Maintenance of Irrigation Equipment.* The project will establish a workshop to repair irrigation equipment and its surrounding.

V.11. ***Institutional Base Development.*** This component will involve training at all levels of farmers and extension agents to enhance their capacities in managing their resources. It will also establish functional organizations for marketing, input supply, natural resources conservation and water management. The project will provide them with facilities, equipment and training.

V.12. ***Extension.*** The project will also support the extension system in disseminating information to farmers and giving them advice on matters technical, economic, marketing and finance.

V.13. ***Project Organization Management.*** A project coordinating unit will be established to ensure efficient implementation of the project. It will coordinate with partners and implementation agencies. The organization will be responsible for preparing *Annual Work Plans and Budgets* (AWPBs) and monitoring and evaluation.

VI. INDICATIVE COSTS

VI.1. The indicative project costs are given in Table 2 below. They are based on experiences of similar project costs implemented in this country. The investment costs are presented for each component. The major costs were based on domestic price quotations taking into account inflation rates and availability of local construction materials in the specific project area, which has a major influence on project cost. To determine the costs for the irrigation infrastructure and wells, local standards have been taken as a guide as there are many similar projects in the country. Where no local information was available, international standard costs for irrigation per unit area have been used. In addition, 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. The cost summary by component is shown in Table 2.

Table 2: Cost Summary per Component

Component	Local	Foreign	Total (US$)	% Foreign Exchange	% of Total Base Cost
Irrigation Development	1,108,650	6,282,350	7,391,000	85%	42%
Drinking Water Supply Development	454,984	1,819,936	2,274,920	80%	13%
Crop Development	43,367	373,470	416,837	90%	2%
Soil Conservation	329,850	329,850	659,700	50%	4%
Socio–economic Infrastructure	120,000	1,680,000	1,800,000	93%	10%
Livestock Development	275,000	2,475,000	2,750,000	90%	16%
Research and Extension	250,000	750,000	1,000,000	75%	6%
Institutional Support	100,000	300,000	400,000	75%	2%
Project Coordination	200,000	300,000	500,000	60%	3%
Technical Assistance	–	300,000	300,000	100%	2%
Total Base Cost	2,881,851	14,610,606	17,492,457	84%	100%
Physical Contingency	144,093	730,530	874,623	84%	5%
Price Contingency	288,185	1,461,061	1,749,246	84%	10%
Total Project Cost (US$)	3,314,129	16,802,197	20,116,326	84%	115%
Investment Cost per Beneficiary HH (direct + indirect = 16,605 HH)			*1,211*		

VII. PROPOSED SOURCES OF FINANCING

VII.1. The financing estimates are based on the expected contributions from government, beneficiary communities and aid agencies. The government contribution will include most of the technical and management staff and physical facilities such as offices for implementation. The government will not tax any materials and services imported for use by the project. The arrangement is that the government will in general cover costs of local origin and it will provide the 10 percent counterpart funding. The communities will contribute their share of project through the provision of labour for the labour intensive components. The international financing agencies are expected to meet the costs of equipment, technical assistance and major physical construction.

VIII. PROJECT BENEFITS

VIII.1. The benefits expected will be financial, economic, social and institutional. From the financial stand point, the farmers will be gaining adequate cash income from sales of meat and milk to complement the energy food nutrition of the population. Economic benefits for the country will be by contributing to the national development programme and the national food supply. The benefits from the social aspect will be equity in incomes and improve child nutrition, particularly from milk. From the environment perspective, the project will benefit from improved soil fertility.

VIII.2. ***One Year Farm Budget for Potato.*** The following farm budget was prepared under the assumption that potatoes are harvested twice a year. Cost calculations were made for one hectare of land taking into account data collected through discussions with farmers. Expert estimation of input costs and returns from potato production are based for a normal year and market conditions were also considered to take note of the price differences in the seasons and in the different markets. The assumed farming method is irrigation using water from wells. Although the crop budget indicates high potential for profits, a detailed economic and financial analysis of the project should be undertaken.

Table 3: Potato 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	2,362
Cost of fertilizer	325
Cost of pesticides	266
Cost of oxen power	189
Cost of labour	1,144
Fuel and lubrication	283
Transport costs	472
Total variable Costs	5,041
Total Expenditure	5,326
Returns	
Expected income from potato (320 quintals @ US$29.50) =	9,440
Gross Profit	4,114

IX. IMPLEMENTATION ARRANGEMENTS

IX.1. The project will be implemented within the framework of the relevant 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 Annual Work Plan and Budget (AWPB). 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. The project will require long–term technical assistance in irrigation techniques and water management. Short–term technical assistance will be required in animal and crop production.

XI. ISSUES AND PROPOSED ACTIONS

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

- ***Irrigation.*** The design of water spread and ground water recharging structures require complex designs and the use of competent personnel with adequate experience. To ensure that appropriate designs are produced, adequate data on similar accomplished projects should be also collected and analysis be made. For this purpose, a follow up study must be carried out before the planned feasibility study.

- ***The Integrated Crop and Livestock Models.*** The models presented in this project profile have been prepared based on local knowledge and science, but since this is an entry point towards transforming the traditional production model to an improved model, the parameters taken to prepare the models (production and economic) must be further detailed and tested by carrying out direct observations and involving the beneficiaries.

- ***Soil Conservation Techniques.*** The conservation techniques, and in particular if plants are to be used, must be determined scientifically. There has been some experience in soil conservation in this country, but the viability of such techniques needs to be tested. It is also important to ensure the willingness and cooperation of the local community to participate in this activity.

- ***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.

- ***Land Tenure.*** The existing rotational land tenure system is not conducive to farmer investment in long term activities like soil conservation and irrigation. Innovative ways must be found to go around this bottleneck if some of the project proposals are to succeed.

- ***Organization and Function.*** The implementing body, which is likely to be Zoba Debub Administration, must start to effectively establish the required organizational set up at the project area, regional and national levels. The CBOs formation and their training must be made early enough. The project will require several local committees to run water, land and other management activities.

- ***Link with Funding Agencies.*** It is essential that clarity is made on how the aid agencies are to participate in the project.

- ***Environment.*** It is necessary that *Environmental Impact Assessment* (EIA) of the project area is conducted. The water development activities planned to be implemented as part of the TPIDP–1 are mainly aimed at rehabilitating the environment by recovering the dropping groundwater table in the project area and for that reason there is no serious environmental concern envisaged at this project formulation stage. However, proper EIA is required before project implementation to identify potential environmental impacts that could drive from construction of water spreading facilities and small reservoirs. The proposed EIA will be expected to come up with necessary mitigation measures and an efficient environmental management plan.

XII. POSSIBLE RISKS

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

- ***Irrigation Water.*** There is inadequate data on the flows of the rivers designated to be used for the proposed spate irrigation schemes. Thus the risk of variation in irrigation water volume and river flow occurrences should be evaluated and further studied.

- ***Delays in Implantation.*** A risk of not implementing the project within the planned time framework may occur. Thus, the capacity (finance, personnel) of the implementing agency should be in place in time.

- ***Availability of Competent Personnel.*** It is likely that competent and experienced personnel may not be locally available to coordinate, manage and lead this project.

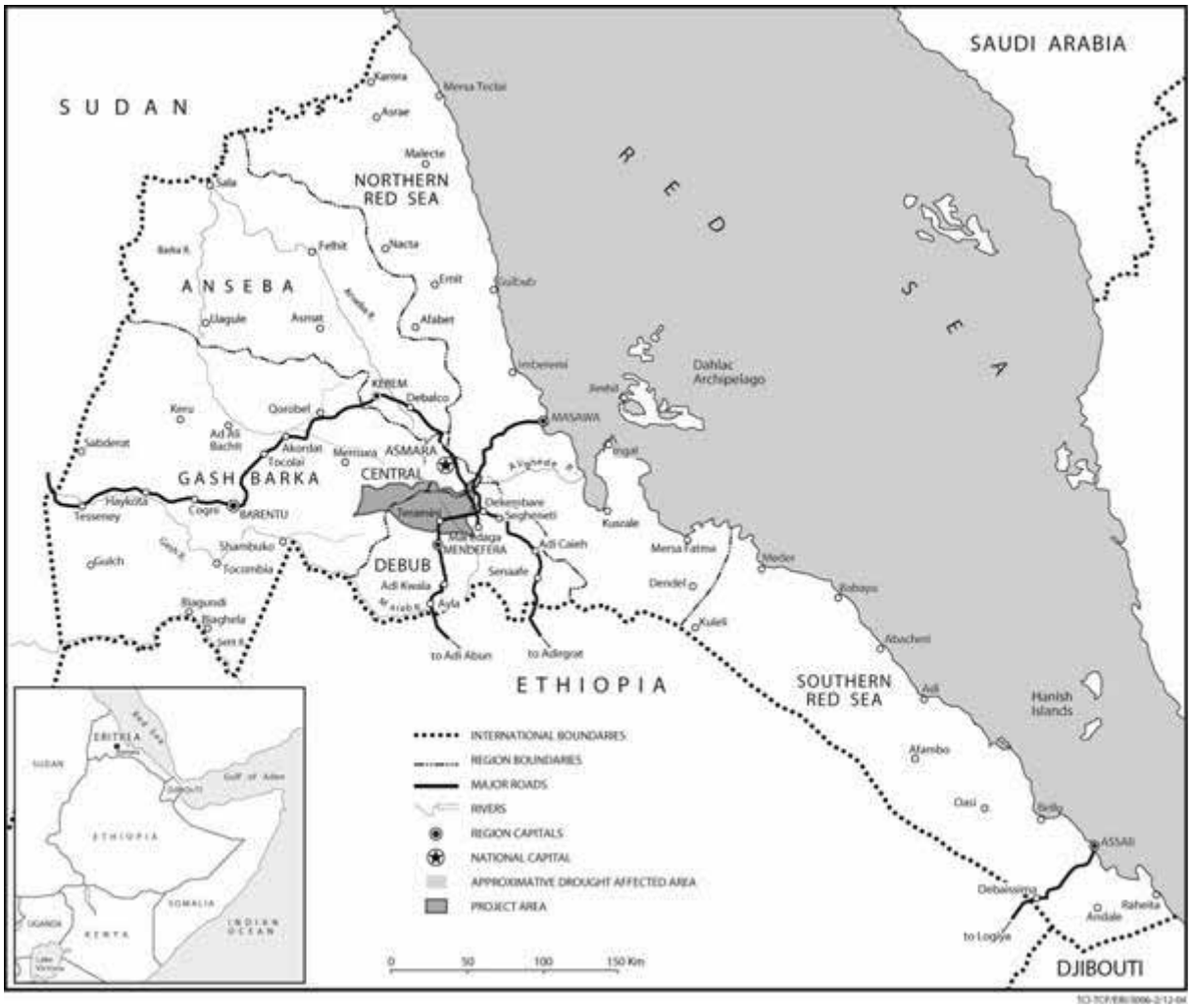
ANNEXES:

Annex 1: Map of Eritrea Showing Location of Project Area

Annex 2: Livestock Component Indicative Financial Returns

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

Annex 1: Map of Eritrea Showing Location of Project Area



Annex 2: Livestock Component Indicative Financial Returns

Dairy Cattle Model (4 Breeding Cows/HH)

Production Coefficients	Value
Age first calving (month)	33
Calving interval (month)	12
Milk yield/cow/day (kg)	13
Lactation period length (day)	280
Length production life (year)	8
Fertility rate (%)	95
Calf mortality/year up to mortality (%)	2
Adult mortality/year (%)	1

Farm Budget (HH)				
	Unit	Qty.	Value (Nakfa)	
			Unit	Total
Income:				
Milk: yield 13 kg per cow/day; 250 lactation period/days; 3 lactation cows = (+) 50 kg of milk/year; 270 kg/calf @ 3 calves = (–) 810 kg; (–) 365 kg home consumed = (–) 8,575 kg	kg	8,575	6.5	55,737.5
Heifer in–calf @ 3–2/years	Nº	1	24,000	24,000
Steer @ 400 kg liveweight	kg	400	40	16,000
Manure 3 t per head/year; 7 TLU total cattle	t	15	600	3,000
Total Income				98,737.5
Expenses:				
Forage (1 ha land): 2.4 t/head/year; 7 TLU = 16.8 t/year	t	16.8	1,300	21,840
Supplement concentrates: 2.5 kg/head/day @ 5 LTU = 4.5 t/year	t	4.5	4,000	18,000
Veterinary				3,000
Labour (family)	person–day	365	40	14,600
Transport (share community)				3,000
Miscellaneous				6,000
Total Expenses				66,440
Profit (before tax)				32,297.5

Project Area Total Annual Financial Result

Total breeding cows	1,600
Total HH	400
Total return/HH (Nakfa)	32,297.5
Total annual financial return of project area (Nakfa)	12,919,000

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 Potato				
Item	Unit	Qty.	Cost (Nakfa)	
			Unit	Total
Seed cost/sprouted tuber	quintal	20	800	16,000
Land preparation (ploughing)	oxen days	12	80	960
Ridging	oxen days	4	80	320
Planting	person–day	10	50	500
Fertilizer manure	truck	2	900	1,800
Urea	quintal	2	200	400
Irrigation				
Fuel	litre	180	10	1,800
Oil	kg	4	30	120
Labour (irrigation)	person–day	60	50	3,000
Weeding	person–day	45	50	2,250
Pesticide				
Insecticide	litre	3	200	600
Fungicide	litre	6	200	1,200
Harvesting labour	person–day	40	50	2,000
Transport to market	quintal	160	20	3,200
Total costs				33,050
Yield per hectare	quintal	160	400	64,000
Net benefit per ha				30,950

Cost of Production for Teff				
Item	Unit	Qty.	Cost (Nakfa)	
			Unit	Total
Seed cost	kg	40	10	400
Ploughing	oxen days	12	80	960
seeding	oxen days	4	80	320
Fertilizer DAP	quintal	1	250	250
Weeding	person–day	40	50	2,000
Harvesting labour	person–day	15	50	750
Threshing field preparation	person–day	2	50	100
Threshing	person–day	10	50	500
Transport to market	quintal	10	20	200
Total costs				5,480
Yield per hectare	quintal	10	1,500	15,000
Net benefit per ha				9,520