Document of

The World Bank

FOR OFFICIAL USE ONLY

Report No. 1934a-YU

STAFF APPRAISAL REPORT

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

July 14, 1978

Projects Department
Europe, Middle East and North Africa Region

CURRENCY EQUIVALENTS*

US$1	=	Dinars (Din) 18.0
Din 1	=	US$ 0.0556
Din 1,000,000	=	US$ 55,555.56

WEIGHTS AND MEASURES

1 kilogram (kg)	=	2.20 pounds
1 quintal	=	100 kilograms
1 metric ton (m ton)	=	1,000 kilograms
1 metric ton (m ton)	=	0.98 long ton
1 millimeter (mm)	=	0.04 inch
1 centimeter (cm)	=	0.39 inch
1 meter (m)	=	1.09 yards
1 kilometer (km)	=	0.62 mile
1 hectare (ha)	=	2.47 acres
1 square meter (m^2)	=	10.76 square feet
1 square kilometer (km^2)	=	0.384 square mile
1 liter (l)	=	0.264 gallon
1 hectoliter (hl)	=	100 liters
1 cubic meter (m^3)	=	1.31 cubic yards
1 million cubic meters (Mm^3)	=	264.2 million US gallons
1 atmosphere (atm)	=	14.7 pounds per square inch (psi)
mmho	=	millimho
ppm	=	parts per million
q hydromodule	=	liters/sec/ha
Q discharge	=	m^3/sec

ABBREVIATIONS

°C	=	degree Centigrade
0/00	=	per thousand
asl	=	above sea level
AU	=	animal units
BOAL	=	Basic Organization of Associated Labor
ETo	=	Evapotranspiration
FAO	=	Food and Agriculture Organization of the United Nations
FNP	=	Federal Fund for the Accelerated Development of the Less Developed Regions
GMP	=	Gross Material Product
hr	=	hour
MW	=	Megawatt
N	=	nitrogen
O & M	=	operation & maintenance
P_2O_5	=	phosphoric pentoxide
Para	=	paragraph
SAR	=	Staff Appraisal Report
SBS	=	Stopanska Banka Zdruzena Banka
SDK	=	Social Accounting Service
sec	=	second
SFRY	=	Socialist Federal Republic of Yugoslavia
SRM	=	Socialist Republic of Macedonia
ZIK	=	Pelagonija Agroindustrial Kombinat = ZIK Pelagonija

FISCAL YEAR

January 1 - December 31

* The Yugoslav Dinar has been floating since July 13, 1973. The currency equivalents given above are those effective in December, 1977.

FOR OFFICIAL USE ONLY

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Table of Contents

This report is based on the findings of a Bank mission which visited Macedonia in October 1977, comprising of Messrs. E.P. Schertz, Y. Suzuki, M. Tirmazi and J.D. Von Pischke (Bank) and J. Marinet (Consultant).

Table of Contents (Cont'd)

I. BACKGROUND

A. The Agricultural and Rural Sector in Macedonia 1/

1.01 Agriculture contributes 23% to the total GMP 2/ of Macedonia, and absorbs 32% of the active working population of the Republic. Agricultural production expanded at an average annual rate of about 3.6% between 1966 and 1977. Fruit and vegetable production grew most rapidly, encouraged by the rising relative prices and increased availability of irrigation facilities.

1.02 Agriculture has declined in relative economic importance with the progress of industrialization, but it still remains a dynamic sector in the overall development of the Republic. While the agricultural population declined by 1.5% annually between 1961 and 1971, its labor productivity increased by an average annual rate of about 4.5%. From 1971 to 1975 agricultural employment increased by about 4.5% per year accompanied by a decline in productivity. However, unemployment and underemployment remain high, relative to national averages. Lack of employment and income opportunities in the rural sector had caused widespread emigration by the rural population to the cities or as workers outside Yugoslavia. The emigrating population mostly consisted of young able-bodied persons and has acted as an impediment to full exploitation of agriculture. Recently there is a trend for migrant workers to return to Yugoslavia. Increased income opportunities in individual sector agriculture would help absorb the returning migrant labor, slow down emigration and help them settle on farms.

B. Organization of Macedonia's Agricultural Sector

1.03 Agriculture in Macedonia, like that of the rest of Yugoslavia, is characterized by the parallel existence of two sectors - social and individual.

1.04 The social sector consists of agricultural kombinats, state farms and agricultural cooperatives and other organizations such as veterinary and research stations which operate under the principles of social ownership of the means of production and workers' self management. The social sector operates more than 20% of the cultivated land; employs 8% of the agricultural labor force; produces 30% of the agricultural product; and contributes 45% of the marketed agricultural production in the Republic.

1.05 In Macedonia, production in the social sector rose at a trend rate or more than 9% between 1965 and 1975. The main explanations for the rapid

---

1/ Yugoslavia's agricultural sector at the national level is described in Annex 1 of the Second Agricultural Credit Project appraisal report, Report No. 1537a-YU.

2/ GMP is similar to GDP, but excludes certain services, such as public administration, defense, education, health and social insurance.

growth of social sector agriculture are: (i) heavy concentration of investments, absorbing more than two-thirds of the gross fixed investment in agriculture in the post war period; (ii) a greater "intellectual input" of university trained workers; and (iii) greater emphasis on research.

1.06 The individual sector in Macedonia occupies by far the larger part of the cultivated land and employs more than 90% of the total agricultural labor force. It consists of about 160,000 farms with an average size of 3.1 ha of cultivated land.

1.07 Production in the individual sector has increased by an average rate of about 3.2% annually in Macedonia since 1965, falling far below the performance of the social sector. The major causes for the low productivity and yields in the individual sector and the increasing productivity gap between the two sectors are: (a) a generally lower quality of land; (b) lower share in the irrigated area; (c) inferior varieties of seeds, plants and animals; (d) low degree of mechanization; (e) low fertilizer input; (f) small farm size and scattered holdings; (g) generally low levels of access to technology and markets; and (h) pricing policies (paras. 6.05-6.07).

C. Cooperation Between the Individual and Social Sectors

1.08 The individual and social sectors are complementary as well as competitive. Labor-intensive crops, such as vegetables and tobacco, are almost exclusively produced in the individual sector, which also has more than 90% of the cattle and sheep. Cooperation between the social and individual sectors takes the form of trade in inputs and output, provision of services by the social sector such as supply of fertilizers, harvesting, cultivations, marketing and credit and the contracting of joint production. While such cooperation benefits individual farmers, it is fairly limited and declining - limited because of the concentration of social sector organizations in the valleys and high plains and consequent lack of cooperation possibilities in the mountains; declining because of the increasing importance of off-farm income of farmers and the dissemination of new production techniques in the sector, both making contract cooperation less attractive to individual farmers.

D. Prices

1.09 Agricultural prices are determined by three systems in Yugoslavia:

(i) Guaranteed minimum prices which the social sector must pay to individual farmers are established for cereals, meat and wool. Government subsidies to the social sector are used when necessary to support social sector purchases.

(ii) Minimum prices without Government guarantee are established for most agricultural products which require processing, including milk, sugar beet, and other industrial crops.

(iii) Goods which are highly perishable and goods marketed in farmers markets are free from Government price controls.

Minimum prices established by Government are adjusted to reflect changes in production costs, world market trends, and social and political objectives. Prices of cereals, meat and wool often exceed the minimum, while prices of products requiring processing have tended to follow Government floors.

1.10 Production which is marketed through the social sector tends to enter the sector through local agro-kombinats. Local monopsony is cosistent with the Yugoslav practice and ideal of combination, integration, and conglomeration in the social sector, based on perceptions of economies of scale. Restricted individual farmer access to credit, except through agro-kombinats, and limitations on the size of individual sector enterprises preserve the pre-eminent role of the social sector and diminishes the possibility of individual farmer choice among social sector produce buyers. This system, under which price policy is effectively controlled through the social sector, introduces distortions in allocation in the economic sense which support priorities within the Yugoslav system. Prices influence cash crop and overall enterprise mix on individual sector farms. However, farmers' planning is simplified by the stability of prices generated by the social sector.

1.11 The production projected to occur at full dvelopment is consistent with the price incentives and constraints to which growers in the project area are subject, as shown by the eight individual farm budgets (para 6.5-6.10) and by the projection for the social sector (Annex 1, Tables 7 and 10).

E. Agricultural Marketing and Agroindustries in Macedonia

1.12 As elsewhere in Yugoslavia, Macedonia has "organized" markets with "authorized purchases" by social sector enterprises existing side by side with "informal" markets where the peasants sell directly to consumers. The dependence of many individual farmers on "organized" social sector marketing and processing channels is relatively high in Macedonia because much individual sector production is grown for markets in other parts of Yugoslavia or for exports. In the mid-1970's more than half of the marketed individual sector production of wheat, grapes, eggs and mutton were sold in the organized markets. Individual farmers also form groups to ship significant quantities (especially of yearly vegetables) directly to local markets of larger cities in the northern Republics.

1.13 Macedonia is a major supplier of fresh produce and tobacco. Nevertheless, the share of Macedonia in Yugoslavia's total processed vegetable production has declined from about 25% in 1960 to about 15% in recent years. Expansion and replacement in Macedonia's processing industry have not kept pace with the expansion of fresh vegetable production (para. 6.03). Macedonia enjoys considerable natural advantage in tobacco production. This labor

intensive crop is well suited for small family farms, and the product is shipped out of the Republic in fully processed and semi-processed form (para. 6.02).

F. Agricultural Development Strategy and Priorities in Macedonia

1.14 Principles and Policies. The basic objective of the Macedonian Agricultural Development Plan is to raise agricultural production to meet expected domestic consumption and some export demand by emphasizing: (a) the further development of the social sector through modernization of production techniques, expansion of processing facilities, better utilization of available resources and the adjustment of production to changes in demand; and (b) the development of individual farms primarily through cooperation with the social sector to achieve further socialization of agriculture and rural areas. 1/ To achieve its objectives, the Plan focuses on (a) price policies, (b) investment policies and (c) support for cooperation between the social and individual sectors.

1.15 Investments and Growth. For 1976-80, the Macedonia Plan projects an annual production growth rate of 4.5% for the agricultural sector as a whole (8.5% in the social sector and 4% in the individual sector). Annual investments are expected to reach Din 1.5 billion in Macedonia, more than a 50% increase against the previous plan period, of which 13% would be in the individual sector. The Plan calls for large investment in the social sector for irrigation, land development and processing facilities, and therefore continues to place major emphasis on the social sector. Incentives involving taxes, depreciation allowances and access to foreign exchange are offered for encouraging mobilization of enterprises' own resources. Measures outlined for the promotion of the individual sector are: (a) increased cooperation between the two sectors and greater individual sector access to extension services in order to achieve a more rapid transfer of modern technology; and (b) provision of credit for on-farm investments.

1.16 These measures address the most tractable bottlenecks in the development of the social and individual sectors. However, the support measures for the individual sector are practically limited to farmers that either form an association or cooperate with the social sector on a contractual basis, in effect excluding farmers in remote regions where the social sector is not well represented and where the scope for cooperation is limited. The Plan apparently recognizes the difficulties facing individual sector development and hence projects realistically low growth rates. The consequent widening gap in incomes between the two sectors will reinforce the emerging trend for farmers in the individual sector to seek additional sources of income outside

---

1/ Socialization is increased in the agricultural sector when value added in social sector agriculture expands at a more rapid rate than value added in the agricultural sector as a whole.

agriculture. Farmers in the mountainous regions who lack alternative economic activities face difficulties in participating in this trend if they choose to remain in their own localities. The projected growth rates for the social sector seem realistic considering the relatively large proportion of investments in irrigation and the corresponding follow-up investments at the farm level.

1.17 Financial and Economic Issues. Efforts to stimulate production have included price policies such as subsidies on inputs, such as fertilizer, and on interest rates. However, low interest rates have not provided much stimulus for the holding of financial assets, while encouraging the use of debt. This situation has led to liquidity structures in the economy which have produced periodic payment crises and to subsequent legislation intended to ensure prompt payment. An interest rate study was undertaken by the Institute of Agricultural Economics in Belgrade under the First Agricultural Credit Project, providing the impetus for a more detailed study to be undertaken as part of the Second Agricultural Credit Project. The Association of Yugoslav Banks and other bodies are also in the process of probing the role of interest rates in the economy.

1.18 The role of interest rates as resource mobilizers and allocators remains ambiguous from the Yugoslav perspective. Resource mobilization and allocation are seen as the proper functions of the planning mechanism, with financial markets serving primarily as channels for moving and processing funds according to the directions evolved by the plan. Banks performing commercial and investment operations form the largest segment of the financial market. Banks are controlled primarily by social sector enterprises which are also the major borrowers. However, a portion of economic activity is undertaken on a modified market basis rather than being subject to the Plan in every detail, which suggests that the interest rate continues to play a role in decision making. Low interest rates have softened one constraint on investment decision making, and some investments in capital intensive technologies has probably taken place which is not in the best interests of employment generation in the agricultural and agroindustrial sector.

1.19 Investment policy has also been used to stimulate agricultural production, and large investments have been made in social sector agriculture. However, few individual farmers have had access to credit for agricultural investments other than farm inputs for crops grown under contract. Liquidity shortages in social sector agro-kombinats making loans to individual farmers have also contributed to individual farmers' severely restricted access to credit.

F. Government Policy and Bank Lending Strategy

1.20 The current system of planning in Yugoslavia ensures a high degree of consistency between the plans of each Republic and Autonomous Province. The development objectives of the 1976-80 Social Plan for the Federal Republic may be summarized as:

(a) Rapid economic growth and more efficient use of resources.

(b) Generation of gainful domestic employment.

(c) Containment of domestic inflation.

(d) Maintenance of an open economy.

(e) Reduced dependence on volatile exports and selective import substitution.

(f) Reduction of income disparity between regions.

(g) More rapid agricultural development.

The implementation of measures designed to fulfill these objectives will occur within the framework of Yugoslavia's political economy, which stressed the social owernship of the means of production; a preference for unitary rather than competing units engaged in use of financial and material resources, but constrained by decentralization, often along regional lines; and decision-making mechanisms designed to ensure widespread participation and conflict resolution at as low a level as possible in the institutional structure.

1.21 The Bank's investment objectives in Yugoslavia may be summarized as:

(a) Support for the less developed regions.

(b) Promotion of agriculture.

(c) Institutional reform and coordination.

(d) Reducing the external resource gap.

1.22 Agriculture is a priority sector from the point of view of both the Government and the Bank, and its enhancement will contribute to the realization of other objectives related to regional income disparities, employment generation and efficiency. The unique position of agriculture as an area for development-oriented intervention by the Bank and the Government results from the sector's structure and the previous record of Government intervention.

1.23 Agriculture is the only major sector other than personal services which social ownership is not predominant. About 85% of the agricultural land in Yugoslavia is privately owned. However, the future of the individual farmer is a very closely bound up with the role of the social sector and the monopoly power conferred upon social sector elements in the food chain. The official Yugoslav attitude toward the role of the indiviudal farmer has changed during the 1970's, and it is now realized that the individual sector contains many unexploited and attractive opportunities caused by discrimination against this sector in resource allocation under previous development strategies. Past emphasis on investment in social sector agriculture, largely to the exclusion

of individual sector agriculture, has increased the possibility of incurring diminishing marginal returns to investment in social sector as opposed to individual sector agriculture. Improvement in the conditions of production in individual sector agriculture is consistent with the national goals of more efficient resource use, employment generation, self-sufficiency in basic foodstuffs, reduction of income disparities for disadvantaged rural groups, and, of course, more rapid agricultural development. Official interest in promoting investment in individual sector agriculture has created opportunities for the Bank in terms of its concern for investment for the benefit of the poor and of less developed regions within countries. In addition, attention to the productive potential of individual sector agriculture is consistent with the Bank's overall interest in increasing agricultural production.

II. THE PROJECT AREA

A. Location

2.01 The project area is located along the Crna Reka (Black River) about 120 kilometers south of Skopje, the Macedonian capital (Map IBRD 13404). The Crna Reka catchment area is surrounded by high mountains: Babuna mountains to the north of Prilep, Bigla and Baba mountains west of Bitola and south to the Greek border, Kozjak mountains on the east. The Crna Reka flows from north to south in the Pelagonija valley, turns east along the Greek border, flowing north to the Vardar river which crosses Greece and reaches the Aegean Sea near Thessaloniki.

2.02 The Pelagonija valley, 60-70 km long and 12-15 km wide, covers 75,000 hectares, of which 21,500 belong to the Strezevo area, and 53,500 ha to the Bucin area. Along the hills are colluvial terraces ranging from 600 to 630 m above sea level, with slopes of 2 to 3%. The central zone ranges from 580 to 600 m, and is flat with alluvia soils. Bitola with 65,000 inhabitants is the main city, forming part of Bitola Commune with 125,000 inhabitants and 151 villages spread over the Pelagonija plain.

B. Climate

2.03 The climate is continental with cold winters and hot summers; frost begins in October and can last till the end of April or beginning of May. Summers are hot and dry with a maximum temperature of 35° in August. The average rainfall in Bitola is 588 mm with snow and rain providing good growing conditions for winter rainfed cereals; but from June to September rains are not sufficient for the production of high value crops. The average daily wind velocity of 1.3 m per second during the summer period poses no problems for sprinkler irrigation, although occasional short interruptions in irrigation may be required because of wind conditions. Sunshine is satisfactory for the crops grown, and for hay production. With the proposed

cropping pattern an average supplementary irrigation of 2,500 to 4,000 m3 per hectare, depending on the crops grown, can provide high yields. Climatic data are presented in Annex 1, Table 1.

C. Topography and Soils

2.04 Topography. The project is composed of two main topographic areas: Flat low lands comprise about half of the project area, with slopes up to 2%, and uplands cover the remaining 50%, with slopes averaging from 2 to 4%. The low lands lie in the alluvial plain of the Crna Reka. The uplands are located on the western part of the project area, with slopes eastward oriented; the southern part of the project area is slightly undulating. Project area topography is not a constraint to sprinkler irrigation.

2.05 Soils. Project area soils are deep; alluvial soils are located in the plain along the river, colluvial soils on the slopes below the water supply canal, with alluvio-colluvial soils between them. All the soils are derived from metamorphic rocks of silicious origin, without any limestone. The alluvial soils, mainly clay-loam soils, were marshlands before the drainage of the plan was completed by 1968. Deep plowing for sugar beet, grown once every 3 years on the heaviest soils of the project, would maintain good drainage and accommodate deep root systems. The colluvial soils have a light texture with a high percentage of fine sand, which may crust on the surface, requiring frequent hoeing during the growing period. From an irrigation viewpoint, 40% of the project area belongs to Class I, 50% to Class II, the remaining 10% to Class III according to U.S. Bureau of Reclamation categories.

D. Farm Size and Land Tenure

2.06 About 8,500 families consisting on the average of 6 persons, live in the 36 villages of the project area, including Bitola. Three thousand families derive their main income from employment in the social sector, working for the ZIK Pelagonija Kombinat on its land or in its factories. Over 9,500 ha, or 47% of the project area, is cultivated by ZIK Pelagonija. The 5,500 farm families working in the individual sector farm over 10,800 ha, or 53% of the project area, in holdings of from less than one hectare to a maximum of 10 hectares, with the following distribution.

45% of the families have a farm of less than 1 ha
31% of the families have a farm 1 to 3 ha
15% of the families have a farm 3 to 5 ha
9% of the families have a farm 5 to 10 ha

Land fragmentation is common. The average plot size varies from 0.2 to 0.4 ha, with farms of 3 to 12 plots scattered all over each village.

E. Employment

2.07 Because of the small size of farms and lack of means to intensify production, underemployment is common and many people go abroad to work. Those abroad are estimated at 10.7% of the active population. It is only during peak periods that full employment is reached. The average per capita income in the project area is about US$260 for the individual sector and US$580 for the social sector.

F. Existing Infrastructure

2.08 Communications. The project area is linked with all parts of Macedonia and Yugoslavia by the Bitola-Skopje railroad, and by the Bitola-Prilep road connected to the main highway from Belgrade through Skopje to Thessaloniki in Greece. In addition, macadam, paved and earth roads link the different villages of the project area. These roads adequately meet the present transportation needs of the project, especially for the social sector. All the villages have electricity; piped water is available in Bitola and some villages, but need to be improved.

2.09 Industry. Part of the present agricultural production is for family consumption and part for processing industries. Five factories belong to ZIK Pelagonija: (a) An old milk plant in Bitola processes 40,000 liters of milk per day with a designed capacity of 20,000 liters. (b) The sugar factory with a daily capacity of 1,500 tons of sugar beet presently works at 60 to 70% of its full capacity with sugar beets from the Strezevo and Bucin areas, plus some production sent from Skopje and other places. (c) The yeast and alcohol factory uses sugar beet factory by-products. (d) A brewery uses local and other cereals. (e) An animal feed factory uses residues from various factories as well as unprocessed agricultural produce. Other factories in the project area, which do not belong to ZIK, include a vegetable and fruit canning factory with a 40,000 ton processing capacity and a flour mill with a capacity of 4,000 tons of cereals. The Lozar wine enterprise in Bitola processes up to 4,000 tons of grapes a year. In addition, a tobacco plant belonging to Jugotutun Bitola and the Titov Veles oil mill buy tobacco and oil seeds produced in the Strezevo area. Two slaughterhouses, one in Bitola, the other at Porodin 10 kilometers from Bitola, do not have any by-product processing facilities.

G. Agricultural Inputs and Supporting Services

2.10 Supporting services for social sector agriculture are the responsibility of the agroindustrial combinat ZIK Pelagonija (para. 4.11). This enterprise is also the largest provider of services to the individual sector (para 4.12). Inputs are available on an ordinary commercial basis at stores

operated by ZIK's Cooperation Center, and inputs specific to contract crops are provided by the processing facilities concerned (para. 4.14). The processing facilities also provide certain services, such as credit and deep plowing for sugar beets, to contract growers. Extension assistance is provided primarily by the processing industry, through specialists for the crops concerned. In addition, several extension agents working for the Republic's Secretariat of Agriculture assist individual farmers (paras. 4.12-4.13).

H. Agricultural Credit

2.11 Bank loans for agricultural and agroindustrial development in Yugoslavia have included four projects involving Macedonian participation, all through Stopanska Banka Zdruzena Banka (SBS). SBS is the Borrower for the Agro-Industries I (894-YU) and II (1371-YU) projects in Macedonia. The first loan financed part of Macedonia's agricultural development program through investments in the social and the individual sectors. Although the program experienced delays, primarily caused by procurement problems and because of cost overruns for which additional financing was difficult to obtain, the project's objectives were generally achieved. All loan funds have been committed, and most will have been disbursed by December 1978 about 6 months later than estimated in the appraisal report except for the final subproject which is scheduled to be completed in September 1979. In general, the professional competence and experience of SBS management and staff have been acceptable, although some difficulties in reporting were experienced. Under the Second Agro-Industries Project greater attention is being focused on management information systems, regular subproject supervision by the Borrower and adequate review and provision for effects of inflation on costs. The Second project makes funds available to eleven social sector enterprises and 1,000 individual farmers for investments in agricultural processing facilities and primarily production, respectively. After a slow start implementation is proceeding satisfactorily. Four agroindustry subprojects have recently been approved by SBS. Tender documents for two of these subprojects have been prepared. Six subprojects for loans to individual subborrowers are being appraised. Appointments of a procurement specialist and a consultant to review the market center study have been delayed by a year, but they are expected shortly. SBS is a participating bank in the two nationwide Agricultural Credit Projects I and II. Under the First Agricultural Credit Project SBS's performance in terms of subproject commitment and disbursement was above the average reported for the eight project banks as a whole. SBS performance under the Second Agricultural Credit project is also satisfactory relative to that of the eight banks as a whole.

2.12 Interest rates in Macedonia range from 3% on certain irrigation loans currently outstanding to 11% on loans funded from Bank loan proceeds. The highest lending rate except for Bank funds is 10.5%, and applies to certain types of loans funded from SBS's own resources. Under the Second Agricultural Credit Project SBS has agreed to floor rates for the portion of

the subloans financed from domestic resources. These minima are 6% on loans to social sector and 5% on loans to individual sectors. On lending outside of projects in which the Bank participates, in 1977 SBS levied rates of 5.5% and 7.0% to agriculture and industry respectively, on loans financed out of resources allocated in Macedonia by the Federal Fund for the Less Developed Regions.

2.13 Almost all agricultural credit is provided in the Bitola commune by SBS which is headquartered in Skopje. Agricultural lending in the Bitola Commune by SBS approximated Din 200 million during 1974-76. More than half of the lending has been short-term. Long-term credit has gone overwhelmingly to the social sector, primarily for the acquisition of farm machinery and livestock. Industrial loans for processing facilities are also used by the social sector. What little long-term loans funds have been made available to individual farmers have been channelled primarily through social sector enterprises which have a contractual relationship with the subborrowers for the delivery of loan-financed produce to social sector processing facilities (para. 2.11). These loans have been mainly for the acquisition of cows, sheep and farm machinery; although in 1977, the first loans for individual sector investments in orchards and vineyards were approved. However, less than 20% of the individual farmers in Bitola Commune have received agricultural credit through the social sector. Short-term credit has been made available to about 15% of the individual sector from processing enterprises for the cultivation of contract industrial crops. The limited availability of institutional credit to individual sector farms can be partly explained by the structure of Yugoslav banks, which are cooperative financing institutions whose founders consist of large social sector enterprises which are also major borrowers. This structure contributes to the highly skewed distribution of credit between the two sectors.

2.14 Project Formulation. The Pelagonija plain, consisting of 81,200 ha of net irrigable land, is the largest basin in the Socialist Republic of Macedonia. Physical and geographic features divided this plain into two regions suitable for the developmnt of independent irrigation systems:

Irrigation	Bitola Region	Prilep Region	Total	Status
	ha			
Strezevo	20,300	-	20,300	Planned
Bucin	22,000	22,900	44,900	Planned
Prilep	-	5,000	5,000	Completed
Krapa	-	8,000	8,000	Under construction
Konjarka	3,000	-	3,000	Planned
Total	45,300	35,900	81,200	

Only a few years ago the Pelagonija basin was a marshy area subject to frequent floods. More than 50,000 ha were constantly or periodically submerged. The

1958-63 Pelagonija dewatering scheme included regulation and training of main rivers and a construction of main drainage and peripheral collector canals. Erosion control works were also implemented including torrent regulation. Protected and dewatered lands now form the production base for agricultural development which could be enhanced with irrigation. The Government of SR Macedonia informed the Bank that of the remaining projects at the planning stage it placed the highest priority on the Strezevo System. A number of Bank preparation missions visited the project area from 1975-1977. Initial project preparation was entrusted to the FAO/WB co-operative program and was followed up intensively by the Bank. Design of the Strezevo dam was completed by Hidroelectroprojekt of Skopje and reviewed by a Bank consultant. The design of the alimentation canal, main canal and the irrigation network was prepared by Melioproekt, another Skopje based engineering enterprise, and was reviewed by Bas Rhone de Languedoc of Nimes, France, one of the Associates of "Gersar". The hydrology of the seven Baba mountain streams forming the source for the alimentation canal was reviewed and updated by the Jaroslav Cerni firm of Belgrade. Preparation of the agricultural component, compilation and translation of the project documents was achieved through the co-operation of Energoprojekt of Belgrade. The SRM Secretariat of Agriculture and Stopanska Banka Skopje were intimately involved with all stages of project preparation. Various alternative engineering solutions including a closed pressure pipe system were considered and the present varient was adopted as it represented the least cost solution for the use of available resources and fitted well within the country's development plan for agriculture.

III. THE PROJECT

A. Objectives

3.01 The main objectives of the project are to increase crop production on 20,300 ha, to raise labor productivity and farm incomes, to create employment in an area where unemployment and emigration are among the highest in Yugoslavia and to substitute for food imports. Other elements include supplying bulk water to the municipal water authority, and to the electric power authority for cooling system makeup water requirements in a thermal power plant currently under construction. Institution building objectives include expanding and upgrading the operation of the project authority, Vodostopanstvo (para. 4.01), and strengthening Stopanska Banka's involvement with the agricultural sector (para. 2.11). The project is appropriate in terms of the Bank's objetives in Yugoslavia. It promotes agriculture in a low income area of a less developed region where public finance constraints limit infrastructure investment. In addition, the project supports institutional reform by increasing socialization in the agricultural sector, creating more employment opportunities inside and outside the sector in the process. The principal project works are summarized in Section B.

B. Project Works

3.02 The project would include investments for the construction of:

(a) the Strezevo dam, located on the Semnica River 15 km northeast of Bitola. This dam, made of rockfill with a clay core, will have a capacity of 112 Mm3 and a height of 84 m;

(b) a 62 km alimentation canal tapping peak season flow (October to May) from seven streams on the Baba Mountains;

(c) a 45 km main canal, with a 30 km covered section along steep mountain slopes, equipped with Amil or similar gates for upstream regulation;

(d) a gravity fed sprinkler irrigation network to supply an average annual volume of 86 Mm3 water for 20,300 ha, sized to meet July/August peak demand, consisting of portable flying lines for the individual sector (10,800 ha) and a rotating boom system for the social sector (9,500 ha);

(e) surface drains connected to the existing drainage system;

(f) administration buildings for each of the operating sections in the project area, office space for the central project management, and equipment and maintenance buildings;

(g) 63 km of 5 m wide asphalt access roads, and farm dirt roads 4 m wide parallel to the secondary pipes;

(h) a pipeline to provide 12 Mm3 bulk water annually to the thermal power plant intake on the Crna River;

(i) diversion structures from the alimentation and main canals for the delivery of 22 Mm3 bulk water annually for domestic and industrial consumption in the town of Bitola; and

(j) preparation of feasibility and preparation studies for three possible irrigation projects in Macedonia.

Detailed descriptions of individual project components are provided in Annex 2. during negotiations assurances were obtained that the project features as described above and in Annex 2 would be carried out.

C. Status of Design 1/

3.03 Strezevo Dam. Detailed final design of the dam and its appurtenant structures, based on adequate site investigation works has already been completed, and reviewed by a reputable consultant. Foundation stability problems have been resolved by providing a down stream berm (Annex 2, para. 4). Tender documents, separately for the diversion tunnel and the remaining structures, were prepared by Hidroelectroprojekt (para 4.05). Assurances were obtained to that effect during negotiations. Employment of a panel consisting of at least three experts not associated with the design and construction of the dam to review the dam design prior to and during its construction would be a condition of effectiveness. This requirement is based on the seismic history of the region.

3.04 Canals. Alimentation canal design has been completed by Melioproekt in sufficient detail for preparation of tender documents. The reviewing consultants, Bas Rhone de Languedoc recommended upstream regulation of the main irrigation canal through installation of suitable hydromechanical equipment e.g. Amil type gates or similar. The design would be revised to include these gates and silting tanks at the site of offtakes from the main canal.

3.05 Irrigation Network and Portable Farm Equipment. Preliminary design of the network has been prepared by Melioproekt and reviewed by Bas Rhone de Languedoc. The recommendations made by the reviewing consultants particularly in respect of pressure regulation and protection against water hammer are being incorporated in the design. The final design would be again reviewed by the consultants prior to the preparation of tender documents.

D. Implementation Schedule

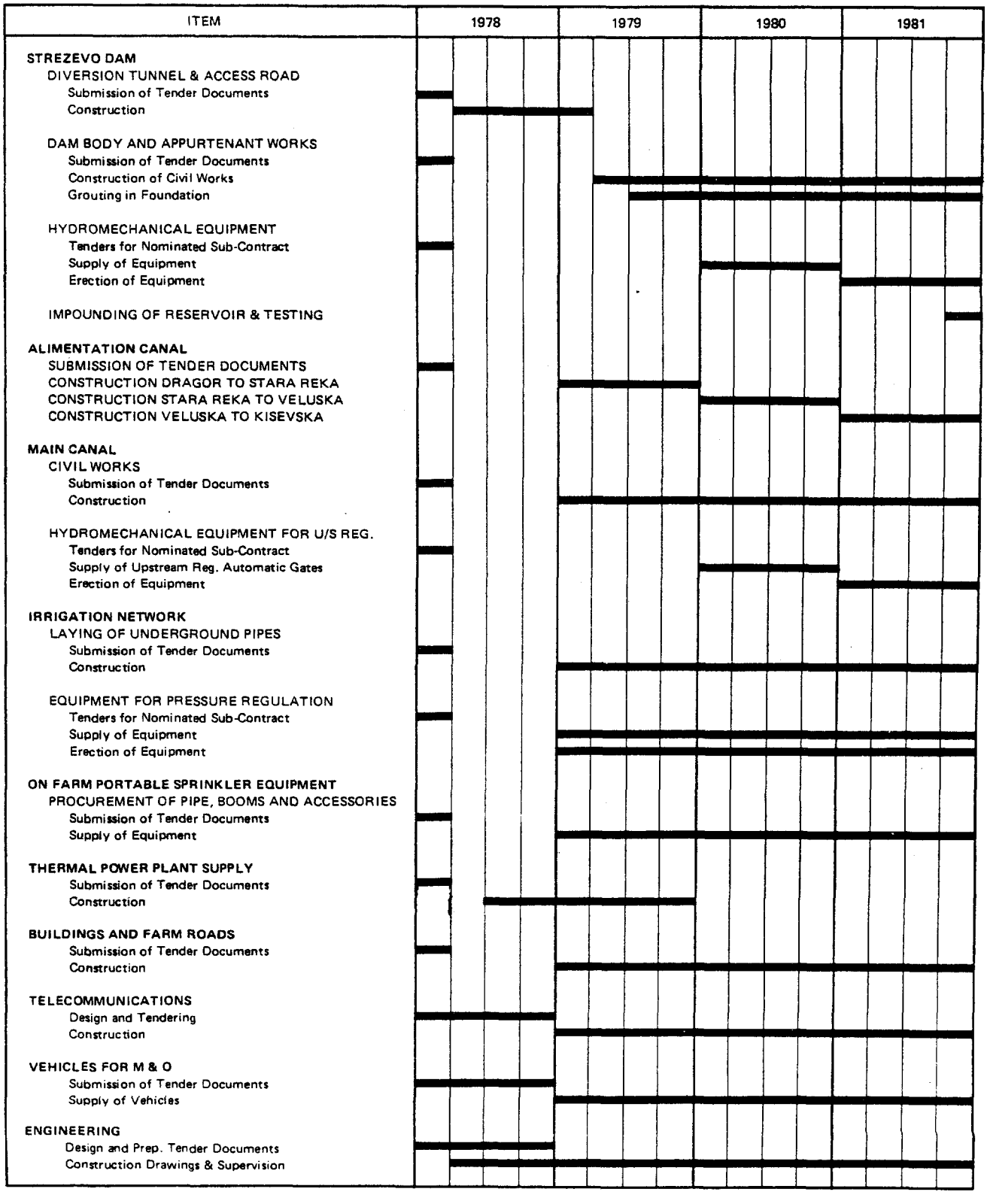
3.06 The proposed project would be implemented over a four year period from January 1978 through December 1981 (Chart 3.1). Irrigation would commence in 1982 on the full area (20,300 ha), bulk water supply to the thermal power plant would begin in 1980, and the bulk water supply to the Bitola town water system in 1982. An estimated schedule of expenditures is given in Annex 1, table 2 and is summarized below:

Calendar Year	1978	1979	1980	1981
Annual Estimated Expenditure (US$ millions)	32.1	51.2	53.8	38.8

1/ See Annex 2 for details.

Chart 3.1

APPRAISAL OF
MACEDONIA STREZEVO IRRIGATION PROJECT
YUGOSLAVIA
Implementation Schedule



World Bank – 18576

E. Cost Estimates

3.07 The total project cost, including physical and price contingencies, but excluding interest during construction, is estimated at US$174.4 million. The base cost estimate includes customs duty and taxes on imported equipment and is expressed in January 1978 prices which were obtained by increasing January 1977 estimates by 12%. The foreign exchange component, which includes both direct and indirect foreign costs, is estimated at US$69.7 million or 40% of the total cost. The base construction cost estimates are based on unit rates derived through analysis of owning and operating costs of construction equipment and unit quantitative costs for major items of work. The unit prices, which include about 8% for taxes and duties are in line with recent bid prices for similar work. Physical contingencies of 15% have been applied to Strezevo Dam, 10% to other civil works and 5% to equipment. Expected price increases over the implementation period amount to about 21% of base cost plus physical contingencies, assuming the following annual rates of inflation for local and foreign costs:

	Inflation Rate (%)	
	1978-79	1980-81
Civil Works	10.0	10.0
Equipment	7.5	7.0

Table 3.1: SUMMARY COST ESTIMATE

Item	Estimated Cost			Estimated Cost			Foreign as % of Total
	Local	Foreign	Total	Local	Foreign	Total	
	---- Din million ----			--- US$ million -----			
Irrigation Works	1102.9	759.4	1862.3	61.3	42.2	103.5	41
Equipment	86.4	172.2	258.6	4.8	9.6	14.4	67
Land Compensation	133.4	-	133.4	7.4	-	7.4	-
Engineering and Administration	111.3	2.2	113.5	6.2	0.1	6.3	1
Base Cost	1434.0	933.8	2367.8	79.7	51.9	131.6	
Physical Contingencies	127.8	101.8	229.6	7.1	5.7	12.8	44
Price Contingencies	332.6	208.4	541.0	18.5	11.5	30.0	39
Strezevo Constructions Cost	1894.4	1244.0	3138.4	105.3	69.1	174.4	40
Irrigation Feasibility Studies	16.2	10.8	27.0	0.9	0.6	1.5	
Interest and Other Charges on Bank Loan During Construction	--	233.0	233.0	--	12.9	12.9	100
Total Project Cost	1910.6	1487.8	3398.4	106.2	82.6	188.8	

F. Financing

3.08 The proposed Bank loan to SBS of US$82 million would finance 99.3% (a) the estimated foreign exchange component of the project cost, and (b) the estimated interest and other charges on the proposed Bank loan during construction. Bank funds would not finance the payment of local duties and taxes. The project's local construction cost of US$105.3 million would be met by equity contribution from enterprises in the Commune of Bitola, a grant from SRM and loans from SBS and local banks as indicated in para. 3.09. SBS would be obligated throughout the construction period to provide adequate funds for carrying out the project. The proposed SBS loan funds obtained from FNP would

be for 20 years, including 4 years of grace. The proposed loans from SBS's own funds and other local banks would be for 10 years, including 4 years of grace. In accordance with the current Bank policy, the proposed loan would be in standard terms for Yugoslavia, 15 years including 3 years of grace. Any gains or losses under the Bank loan which arise from changes in currency parities would be for the account of Vodostopanstovo. SBS would in turn take adequate steps to protect itself against the foreign exchange risk on funds accruing to it from subloan repayment before they are needed to make amortization payments on the Bank loan. SBS would receive 0.5% spread on IBRD funds to cover administrative costs (para 4.01).

3.09 The financing plan for the four year construction period would be as follows:

Expenditure Type	Civil Works Equipment Buildings & Vehicles	Foreign Exchange Payments to Consultants	IBRD Interest During Construction	Working Capital	Other	Total Project
	US$ Million					
Capital Expenditure	174.2	0.2	-	-	-	174.4
Pre-Operating Expenditure	-	-	-	-	3.9	3.9
Working Capital	-	-	-	0.6	-	0.6
Interest during Construction	-	-	12.9	-	7.5	20.4
IBRD Loan Amortization	-	-	-	-	3.4	3.4
Irrigation Feasibility Studies	0.9	0.6	-	-	-	1.5
	175.1	0.8	12.9	0.6	14.8	204.2
Funding Source						
Loans						
IBRD	68.9	0.8	12.3	-	-	82.0
SBS /1	79.5	-	0.6	0.6	5.0	85.7
Grants						
S.R. Macedonia	11.1	-	-	-	-	11.1
Equity Subscription						
Bitola Enterprises	15.6	-	-	-	-	15.6
Project Cash Generation	-	-	-	-	9.8	9.8
	175.1	0.1	12.9	0.6	14.8	204.2

/1 Includes US$67 million from the Federal Fund for the Accelerated Development of the Less Developed Regions.

Assurances on the loan terms and sources of financing in paras. 3.08 and 3.09 were obtained during negotiations. Assurances were obtained during negotiations that quarterly installments of grant and equity subscriptions would be made available to Vodostopanstvo's BOAL Strezevo according to a predetermined schedule agreed by the Bank, and that the first installment of grant and equity subscriptions would be received on or before December 31, 1978. Finalization of all the financial arrangements would be a condition of effectiveness.

G. Procurement

3.10 Contracts for civil works and equipment financed under the proposed Bank loan would be grouped, to the extent practicable, into 10 contracts and would be tendered in accordance with Bank Guidelines. Of these, 5 contracts totalling about US$152.2 million would be tendered for international competitive bidding. The lower of a 15% preference or prevailing custom duty margin would be extended to local manufacturers in the evaluation of bids for equipment under international competitive bidding. Only the major equipment contract of about US$11.4 million for sprinkler irrigation equipment is likely to be won by foreign suppliers. Due to the competitiveness of the Yugoslav contracting industry the other 4 ICB contracts are likely to be won by Yugoslav firms.

3.11 Procurement in accordance with local competitive bidding procedures, acceptable to the Bank, would be appropriate for the remaining 5 contracts totalling about US$6.2 million for items such as the diversion tunnel, access roads, power plant pipeline, buildings, vehicles and telecommunications. The diversion tunnel, access roads and power plant pipeline have been advance, contracted and procured locally to avoid delays in project implementation. Tender documents and selection of contractors for the above components would be subject to prior Bank review. Buildings, vehicles and telecommunications procurement (US$1.2 million) would be phased with the construction of major project components and best be coordinated through small local contracts. During negotiations, assurances were obtained that the procurement procedures outlined in paras. 3.10 and 3.11 would be followed.

H. Retroactive Financing

3.12 Although most of the proposed project is on a normal time path, the timely construction of two specific components of the project (diversion tunnel for the dam and bulk water pipeline to the thermal power plant) are important to financing, viability and justification of the project. Construction of the project can be achieved in four years only if full use is made of each annual working season. Construction seasons are limited because of severe winter conditions, complicated by high water flow early in the year. Therefore, the diversion tunnel works and access roads construction was begun in June 1978 to take advantage of the 1978 construction season. A one year

delay would result in a significant increase (about US$20 million) in total project costs, adversely affecting both the financing plan and the economic justification. The timely construction of the thermal power pipeline is equally crucial. If there were a delay in the completion of this project component, the power plant would be forced to develop alternative sources of water for an interim period and would not need, or be ready to use, the pipeline water until two years later when an additional generating unit is expected to be installed. In that case, the project agency would be deprived of an estimated US$10 million in water revenues leaving a gap in the financing plan.

3.13 Advance contracting through local procedures to the extent of US$5.0 million has been necessary for the construction of the diversion tunnel, access roads and thermal power pipeline. Retroactive financing of these expenditures up to the amount of US$700,000 is recommended under the project. Contracts for the diversion tunnel, access roads and thermal pipeline have been awarded to Yugoslav construction firms.

I. Disbursements

3.14 The proposed Bank loan of US$82 million would be disbursed net of taxes and import duties over five years as follows:

(a)	Civil works, equipment, vehicles and building (US$47.5 million)	35%
(b)	Sprinkler irrigation equipment (US$11.4 million)	100% of foreign expenditures and 100% of local expenditures, ex factory
(c)	Consulting services (US$0.2 million)	100%
(d)	Interest and other charges on the loan accrued on or before September 14, 1981 (US$12.3 million)	Amounts due
(e)	Irrigation feasibility studies (US$0.6 million)	40%
(f)	Unallocated (US$10 million)	

The grant from SR Macedonia of US$11.1 million and the equity contribution from Bitola enterprises of US$15.6 million would be used to cover 14% of the disbursements for construction costs by Vodostopanstvo. The SBS loan of US$79.5 million would cover 46% and the IBRD loan of US$57.5 million would

cover 35% of the amount disbursed for construction costs. An estimated schedule of disbursements is in Annex 1, Table 4. Bank disbursements would be made against standard documentation.

J. Accounts and Audit

3.15 SBS would maintain a separate account for the project. As required by Yugoslav law, all banks and enterprises are audited annually by the Social Accounting Service (SDK) which is acceptable to the Bank. A full unqualified audit report on SBS for 1976 was produced by SDK following generally accepted standards. Assurances were obtained that SBS would submit audit report satisfactory to the Bank, within six months from the end of each fiscal year.

3.16 Vodostopanstvo would establish appropriate record keeping and reporting procedures. Vodostopanstvo (para. 4.02) would maintain separate accounts for all financial transactions under the project it would submit annual reports audited by SDK and acceptable to the Bank within six months of the end of the fiscal year. Assurances to this effect were obtained during negotiations. Vodostopanstvo would also recruit qualified accounting personnel able to handle the requirements arising from the project, including a Financial Director who would be selected with the concurrance of the Bank. The appointment of the Financial Director would be a condition of loan effectiveness.

K. Monitoring

3.17 In order to measure project implementation and subsequent performance against the construction schedule, costs and benefits foreseen during appraisal, SBS would submit periodic reports to the Bank. These would include data on project expenditures and on construction of all physical facilities under various project components. Information brought under irrigation, operation and maintenance costs and cropping pattern would be submitted annually when facilities become operational. During negotiations, details of the format in which the above information would be furnished to the Bank were agreed.

3.18 It was agreed during negotiations that after completion of the project, but not later than December 31, 1983, SBS would prepare and supply to the Bank a report on the execution and initial operation of the project, its costs, the benefits derived and to be derived from it, the performance of the Bank and SBS of their respective obligations under the proposed loan agreement and the accomplishment of the purposes of the proposed loan.

L. Environmental Effects

3.19 The present uncontrolled flow of the Semnica River during summer months decreases at times to 0.04 m3/sec. However, a minimum biological discharge from the Strezevo reservoir of 0.20 m3/sec would always be maintained. This minimum would exceed the historical flow of the river during dry periods and because of its steady nature would have a salutory effect on the regime of the river and its environment.

3.20 The areas proposed to be irrigated by the project were once a part of the Pelagonia swamps. These lands have been reclaimed over the past few decades. A surface drainage system proposed as an integral part of the irrigation network would improve drainage conditions and help support an environment well suited to human and plant life.

3.21 The availability of safe and adequate water supply to the inhabitants of the city of Bitola and its vicinity through the year 2000 would be ensured by the project. At present, a large section of the population is not served by a dependable supply of hygienic water because of the limited resources of the town's treatment plant, augmented by heavily mineralized ground water which is a source of constant complaints by Bitola residents.

3.22 The overall environmental effects of the project are, therefore, expected to be positive and beneficial.

M. Water Rights

3.23 The Semnica Reka and Baba mountain streams, from which a substantial portion of water for the project would be drawn, flow into the Crna Reka, which in turn flows into the Vardar River, which flows through Greece. The seasonal nature of the flow of the Semnica Reka and Baba mountain streams is such that water for project use would be drawn primarily during the winter and stored for summer use; hence, this would not adversely affect the summer flow of the Vardar River. The Vardar River is the subject of agreements governing riparian rights between Yugoslavia and Greece. Its provisions relate particularly to the situation between May and September when the rivers flow is least. The Government has submitted to the Bank a statement that the proposed diversions for the project comply with the agreements and a statement by the Greek Government acknowledging that they have been duly notified of the proposed works and that the works meet with their agreement.

N. Role of Women

3.24 Yugoslavia has made considerable progress with respect to ensuring equal opportunity for women. The project has no specific component designed

according to differentiations based on the sex of intended beneficiaries. It is expected that women will benefit as much as men, and possibly more. More opportunity for gainful employment of women on individual farms and on social sector land will be achieved directly under the project, and additional jobs will be created in other parts of the food delivery system by the increase in production projected to occur with the project.

IV. ORGANIZATION AND MANAGEMENT

A. Project Organization

4.01 Borrower. Stopanska Banka of Skopje would be the borrower under the guarantee of the Socialist Federal Republic of Yugoslavia. SBS would be responsible for fund mobilization from local banks and Government for on-lending to Vodostopanstvo, for loan administration and for financial coordination and supervision. The structure and operation of SBS particularly as they relate to agricultural lending, are described in Appraisal Report 1316a-YU, for the Agriculture and Agroindustries II Project - Macedonia, dated January 1977. No material changes took place during 1977.

4.02 Implementing Agency. The project authority would be the Pelagonija Water Economy Enterprise (Vodostopanstvo) headquartered at Bitola. This is a financially autonomous enterprise headed by a workers' council, an executive committee and a general director. It has successfully completed a large drainage project in the area, as well as flood and torrent control projects. The overall responsibility for planning, construction and maintenance of all project works would rest with Vodostopanstvo. It would finalize designs, prepare and evaluate the bids, and coordinate construction on all components of the project. With suitable strengthening and consulting assistance, Vodostopanstvo is competent to execute and operate the Strezevo Irrigation project. The Bank would sign a project agreement with Vodostopanstvo, which would be the subborrower. Vodostopanstvo would as a condition of effectiveness sign a subsidiary loan agreement with SBS.

B. Vodostopanstvo and BOAL Strezevo

4.03 For efficient project implementation, Vodostopanstvo's organization and financial structure require some alteration. A separate Basic Organization of Associated Labor, BOAL Strezevo, would be established within Vodostopanstvo having as its sole and exclusive responsibility the implementation of the project and the operation of the system after it is completed. This organizational change is consistent with Yugoslav self-management practices, and is necessary because Vodostopanstvo's current operations are diversified, and because its financial situation has not strengthened over the last five years. BOAL Strezevo would operate in a financially autonomous manner (para. 3.16) so that its assets and cash flow would not be available to support the operation of other Vodostopanstvo activities and units. However, Vodostopanstvo would be ultimately responsible for the activities of BOAL Strezevo on the same basis

as for its other constituent BOAL's. BOAL Strezevo would be headed by a director and would have four separate divisions: exploitation, financial, technical and general and legal affairs (Chart 4.1). BOAL Strezevo would have its headquarters in Bitola and its director would be a qualified engineer experienced in construction, operation and maintenance of similar works, selected by Vodostopanstvo prior to loan effectiveness and whose qualifications and experience would be satisfactory to the Bank. The director designate of BOAL Strezevo participated in negotiations. Assurances were also obtained that Vodostopanstvo would appoint other key staff by December 31, 1978. Adequate number of qualified professionals exist in Macedonia, permitting timely fulfillment of this requirement. Any further reorganization within Vodostopanstvo affecting BOAL Strezevo would require prior Bank approval. Bitola Commune and SRM would cover in full any financial deficit of BOAL Strezevo during the early years of system operation, while water charges are being phased up to the full development level, until BOAL Strezevo is financially self-sufficient (Annex 1, Table 5, and para. 6.15). Assurances with respect to these matters were obtained during negotiations. Appointment of the Director of BOAL Strezevo would be a condition of loan effectiveness.

C. Project Implementation

4.04 Responsibility for designs and procurement would rest with Vodostopanstvo while the implementation and supervision of construction would be under the control of BOAL Strezevo.

D. Operation and Maintenance

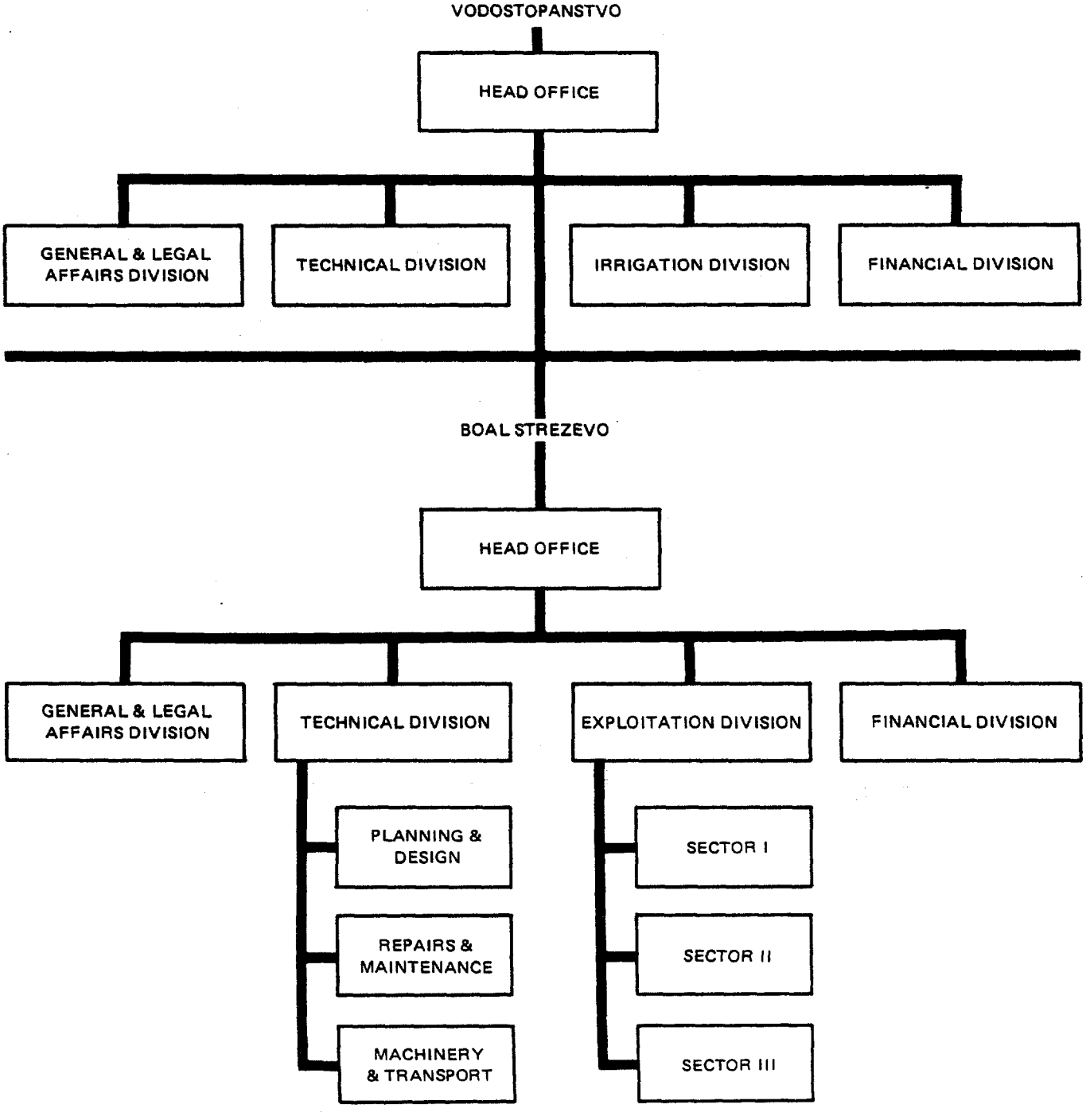
4.05 The irrigation works including the Strezevo Dam would be operated and maintained by BOAL Strezevo assisted by Melioprojekt and Hidroelectroprojekt. Vodostopanstvo would arrange, at intervals of not more than five years, formal safety inspections of the dam and appurtenant structures. Inspection reports would identify actual or potential deficiencies in the condition of these structures or in the quality of their maintenance or methods of operation which may endanger their safety, and specify necessary remedial measures. A copy of each report would be forwarded to the Bank.

4.06 The irrigation works including the dam would be operated and maintained by the three sector offices of the exploitation division of BOAL Strezevo (Chart 4.1). Each sector would serve about 7,000 ha and would be staffed by a maintenance engineer and his assistants. Each sector would have a technical services center and would include a suitable communication link with Bitola. The staff would also record areas irrigated and hours of irrigation and prepare water use data.

4.07 Every year in August, Vodostopanstvo would prepare a plan of system operation for the following year including cropping patterns, movement of portable sprinkler equipment, and deployment of labor for the social and the individual sectors. This annual plan would be submitted to the Commune

Chart 4.1

APPRAISAL OF
MACEDONIA STREZEVO IRRIGATION PROJECT
YUGOSLAVIA
Organization Chart
of
Water Economy Enterprise Pelagonia – Vodostopanstvo
and
Boal Strezevo



World Bank – 18577

Assembly for approval. In addition, Vodostopanstvo would prepare and submit to the Bank by 1980 a detailed plan which would govern the operation and replacement of portable irrigation equipment in the individual sector. Assurances relating to operation and maintenance were obtained during negotiations (paras 4.05-4.07).

E. Consultants

4.08 The project would provide funds for local consultants who have completed preliminary and some final design of the project. These consultants would complete final design, prepare and evaluate bid documents and supervise construction. These consultants are acceptable to the Bank. Vodostopanstvo has agreed to retain foreign consultants to review final design of the pipe network and assist in preparing tenders. Assurances were obtained during negotiations that consultants whose qualifications, experience and terms of employment satisfctory to the Bank would be engaged to periodically inspect the Strezevo dam, waterway earthworks and reservoir banks and their appurtenant structures constructed under the project at intervals of not less than five years in accordance with appropriate engineering practice. The first of such inspections to start not later than December 31, 1983.

F. Training

4.09 Sprinkler irrigation, relatively new in Macedonia, requires special skills for operation. Specialized training for key professionals would be arranged during the construction period. Training would cover efficient sprinkler system operation, maintenance, and movement of portable field equipment. Training in operating techniques is envisaged with existing sprinkler systems. Additional instruction at sprinkler factories would cover equipment repair and establishment of servicing workshops. Assurance were obtained during negotiations that a training program, including an annual training plan, would be proposed and agreed with the Bank by July 31, 1979.

G. Right of Way

4.10 Land acquisition for rights of way and property compensation in agricultural projects is handled by the Republic authorities, with funds provided by the Republic. Assurances were obtained during negotiations that land and rights to land and property would be acquired in a timely manner to avoid delays in project implementation.

H. Agricultural Supporting Services

4.11 The social sector is responsible for agricultural development of 24,000 hectares in the Strezevo and Bucin areas, and ZIK Pelagonija is the organization set up for this purpose. Its staff of 3,300 works in 12 different Basic Organizations for Associated Labor (BOAL's). Three deal with agriculture and livestock, six are industrial (sugar factory, yeast and alcohol factor, brewery, animal feed mill, poultry farm and dairy plant), one deals with transport and two with trade and cooperation with individual farmers. ZIK Pelagonija includes an Agricultural Development Center with experts for different crops, specialists for plant protection, mechanization, irrigation, soil surveys, seed production and control, livestock, analysis and planning; plus an experimental farm and two laboratories, one for pedology and agrochemistry, the other for seed control. The Agricultural Development Center serves in a research and advisory role to improve husbandry and efficiency in the social sector. It also serves the individual sector through demonstrations of the crops and livestock grown by ZIK, and also through direct assistance. Another organization, Lozar, engaged in wine production, deal with orchard and vineyard production in the project area.

4.12 The individual sector farms 10,800 hectares of the Strezevo project. Individual farmers cannot own more than 10 hectares cultivated land. They must follow self-management agreements adopted by the Commune of Bitola concerning varieties to be grown, minimum amounts of fertilizer to be applied, etc. (para. 5.15-5.17). Agricultural inspectors responsible for agriculture, livestock, and irrigation in the SRM Secretariat of Agriculture supervise these agreements. ZIK's Cooperation Center BOAL, which purchases inputs for ZIK, also assists and advises individual farmers through six cooperative units in the Strezevo area. Each unit has a specific geographical responsibility, is equipped with stores for inputs, and provides seeds, fertilizers, pesticides and herbicides and other inputs to farmers. The Center assists individual sector land preparation and harvesting with equipment belonging to ZIK. Land preparation is mainly undertaken by the Cooperation Center for sugar beet, which requires deep plowing and subsoiling which the individual farmers are unable to do with their small tractors. Harvesting is done with combine harversters for cereals and cornpickers for maize, paid for on a per hectare basis. In addition to the assistance provided by the Agricultural Development Center and the cooperative units of ZIK, two other organizations assist individual farmers. The Center for Individual Farmers financed 50% by the Republic and 50% by the Commune has extension agents belonging to the Department of Agriculture who advise individual farmers. Processing factories assist farmers working under contract through extension agents specialized in the crop the factory buys. For farmers working under contract, inputs are provided through loans in kind repaid at harvest time with an interest rate of 6% (plus 6% subsidy from the Government). During 1976-77, all credit was repaid at the time the harvest was sold to the unit.

4.13 The different organizations responsible for extension work would be reinforced for project implementation, providing more assistance to both sectors. From a present average of one extension agent for 140 hectares in the

individual sector, the average would reach one extension agent for 80 hectares. Factories directly interested in the improvement of production in the Strezevo project would continue to play a role of primary importance.

I. Fertilizers, Pesticides and Herbicides

4.14 Today the social sector applies more chemical fertilizers than the individual sector, where consumption is mainly for crops grown under contract. Manure is produced and applied in both sectors. To achieve the high yields expected with the project, fertilizer consumption over the project's 20,300 hectares would substantially increase to more than 14,000 tons of chemicals and almost 100,000 tons of manure annually. Chemical fertilizers are mainly composites locally manufactured from imported raw material for phosphates and potash; nitrogen fertilizers are locally produced. Annex 1, Table 6 lists for each crop the types of fertilizers to be used and application per hectare. Use of pesticides and herbicides would increase with the project, and projected yields would be sensitive to their rational use. Their proper application would be one of the main tasks of the extension agents.

J. Seeds

4.15 Part of the seeds used in the Strezevo project would be selected seeds produced by ZIK Pelagonija, which expects to set up a new division for seed production, in addition to the existing division for seed control. Seeds not produced by ZIK would be produced in other parts of the country or imported. Seeds are provided free of charged by Jogotutun for tobacco grown under contract. Oil seeds and sugar beet seeds are provided by the respective factories.

V. AGRICULTURAL PRODUCTION

5.01 The project would permit a five-fold increase agricultural production over the social and individual sectors, with irrigation available for all crops on 20,300 hectares. Land use would be intensified through double cropping.

A. Present Cropping Pattern

5.02 The social sector is highly mechanized, using modern husbandry methods, fertilizers, efficient pest and disease control, and selected seeds. Nevertheless good summer crops plus double cropping is not feasible with rainfed cultivation. Wheat is the main winter crop, grown over almost 5,000 hectares, with an average yield of 3.8 ton per hectare. The main summer crops

are sunflower, maize and sugar beet grown over a total of 3,700 ha with yields which depend upon the rains. Annex 1, Table 7 shows the present cropping pattern.

5.03 The individual sector is much less developed with lower yields. Although mechanization is already well underway, draught animals continue to be used on the very small farms with resulting seasonal underemployment of draught power. In addition to cereals and industrial crops, some high value crops such as tobacco and summer vegetables are grown with some supplementary irrigation from wells. Annex 1, Table 8 details the existing cropping pattern.

B. Future Cropping Patterns

5.04 In the absence of the project there would be no significant changes in social sector cropping patterns and the cropping intensity would not be increased, except in response to changes in input costs and produce prices. In the individual sector it is expected that a trend of modestly increasing productivity would continue.

5.05 Under the project, the social sector would follow a 3-year rotation with cereals, sugar beet and industrial crops (maize, sunflower, soyabeans and a small amount of tobacco), including some high value crops, mainly industrial pepper production, which can be partly mechanized. Wheat reduced to the minimum required for purposes of the crop rotation would be followed by a second crop, maize silage, during the summer season; fodder peas would follow soyabeans and sunflower. Orchards and vineyards would be replanted and their acreage slightly increased with better and more productive varieties. Alfalfa would be partly consumed as hay or fresh forage and partly sold to the feed mill for alfalfa meal production (Annex 1, Table 10).

5.06 In the individual sector high value labor intensive crops would create employment and increase returns to the smallest farms. On the larger farms partially mechanized industrial tomato and pepper production would be undertaken (para. 5.12). A 3-year cropping pattern on these farms would permit forage production as a second crop. Alfalfa would be consumed on the farm by dairy cattle and sheep raised for family consumption. Late and winter vegetables would be grown over more than one thousand hectares. Orchards and vineyards would be renewed and extended. Wine would be produced on the farm for family consumption, and grapes and other fruits would be grown for the local market (Annex 1, Table 11).

C. Yields and Production

5.07 The social sector and to a lesser extent the individual sector are already able to provide good yields for crops suited to the climatic conditions, mainly wheat. Under irrigation with the project, yields and production

could be greatly improved. It has been assumed that yields of the social sector would reach higher levels than the individual sector, due to more advanced technology and the greater use of inputs. By the fifth year full development for enterprises other than orchards and vineyards would be reached in the social sector and substantially realized in the individual sector.

5.08 For wheat receiving one irrigation in the social sector, a yield of 5.5 tons per hectare would be reached, compared to 4 tons in the individual sector under rainfed conditions. Yields of sugar beet would reach 60 and 50 tons respectively, maize 7 and 5.5 tons, tobacco 2.5 and 2.2, etc. Overall production would widely increase from a total of 92,000 tons of biomass in 1977 to almost 600,000 tons with the project, mainly due to increments in sugar beet and forage.

5.09 Sugar beet would produce the highest revenues in the social sector, tobacco and vegetables in the individual sector (Annex 1, Tables 10 and 11).

D. Cropping Calendar

5.10 Chart 5.1 gives for each crop the growing period and the month by month working days in the individual sector. This Chart shows that maize forage grown as a second crop must be sown very rapidly after wheat harvesting - 2,500 hectares in the social sector and 500 hectares in the individual sector would have to be plowed and sown in no more than 3 weeks. There is enough machinery to do the work in time. Land preparation and sowing of fodder peas would follow soyabean and sunflower harvesting. Early sowing of short growing varieties of soyabeans and sunflower would permit greater forage production. April and the beginning of May would be the peak period for sowing and transplanting, and August and September for harvesting. Sugar beet harvesting would extend over a longer period, but not beyond the end of October because of transportation problems on slippery dirt roads. Timing requirements are rigorous but not beyond the resources and capability of cultivators in all but exceptionally adverse circumstances.

E. Farm Mechanization

5.11 The social sector is already fully mechanized, and ZIK Pelgonija has a fleet of 240 tractors with implements (100 working in the Strezevo project area), and 80 combine harvesters. With the project a more intensive cropping pattern would be followed, requiring more tractors. With wheat production decreasing, no incremental combine harvesters would be required. Additional equipment for maize-silage is necessary, as are sugar beet harvesters for the 2,500 hectares of sugar beet to be grown every year.

5.12 In the individual sector 380 tractors belonging to farmers are already working, although they are underutilized. In addition, the ZIK Cooperation Center has 36 tractors (70 hp to 90 hp) strong enough for deep plowing

and subsoiling for sugar beet cultivation. With the project the higher cropping intensity would require more tractors. Many local people who have left to work in foreign countries would have an incentive return to the project area when irrigation starts, and would be able to buy the equipment they need. Dairy production on the large private farms would require harvesting machines for maize silage production; such equipment would be bought by the Cooperation Center and rented to farmers for harvesting. Very small project farms, which presently use draught animals, would be expected to mechanize. Motor cultivators are not yet used in the project area, but it is projected that 50 motorcultivators would be bought during the first 5 years of the project.

F. Drying and Storage

5.13 During summer months, hours of sunshine are quite high and the farmers have sufficient outdoor drying areas in their villages to handle their wheat and barley crops. Drying is somewhat more difficult for hay making when rains exceed the average. Some social sector alfalfa is sold fresh to the feed mill, which is equipped with dryers, some is consumed fresh, and the remainder is used for hay. Maize grown in the social sector is sold to the feed mill or to the Zitomakedonija flour factory in Bitola which has storage facilities and is equipped for drying if necessary. In the individual sector the drying and storage of maize and alfalfa hay is handled largely according to traditional methods, which are expected to remain adequate. Most of the forage produced with the project would be for silage which would be stored in pits lined and covered with plastic sheets to avoid pollution. The main problem in silage production would be to train farmers to compress the green mass sufficiently to avoid aerobe fermentation. The responsibility for the storage of crops grown under contract rests with the factory concerned. For tobacco, Jogotutun provides assistance to farmers for construction of sheds where the leaves are dried before the are sorted and wrapped by size and quality for delivery to the factory. Grading and packing centers for fruit and vegetable production would be set up with storage capacity for fruits sold to consumers during the winter.

G. Land Use Rationalization

5.14 Land use rationalization with irrigation in the social sector should not pose any unusual problems beyond the managerial capability of ZIK Pelagonija. Its land is consolidated and cropping patterns are already the subject of considerable planning and attention.

5.15 Land use rationalization with irrigation in the individual sector will be a complex process because of institutional factors. Wholesale land consolidation is not to be attempted because it is politically unacceptable. In addition, fragmentation of holdings is perceived by many farmers to have

certain advantages as a hedge against dispossession. Therefore, land ownership patterns will not be changed to accommodate the introduction of irrigation. Because of the extensive fragmentation of holdings which presently exists, farmers have devised methods of cooperation to ensure that land use is rationalized to the extent required to obtain economies of scale sufficient to justify the use of farm machinery and to ensure access to plots for machinery, to exclude animals from land where they could destroy crops, to facilitate mutual assistance and to take advantage of economies in marketing. Such cooperation is encouraged by the arrangements under which farmers voluntarily enter into contracts with social sector produce buyers. Land use rationalization under irrigation is expected to be based on this strong local institution of voluntary cooperation among farmers with respect to land use decision making.

5.16 Centralized efforts to rationalize land use decisions on the thousands of small, fragmented holdings involved would not be able to achieve the flexibility required to ensure that land use patterns harmonize with labor availability and other factors of importance to farmers. These inefficiencies will not be entirely eliminated by the proposed decentralized system, and some of the potential benefits from irrigation of individual sector lands will not be realized because of institutional problems related to land use rationalization. The rate of adoption of the proposed cropping pattern in the sector reflects these and other factors, and full development yields have been estimated conservatively to reflect this probability. The proposed land use rationalization arrangements are nevertheless regarded as optimal. Attempts at maximization through forced land consolidation or centralized decision-making would involve economic and social diseconomies judged to outweigh the benefits foregone under the proposed arrangements.

5.17 Land use rationalization in both sectors would be within the legal framework of land tenure in Macedonia. In 1976, the Socialist Republic of Macedonia passed legislation covering land use rationalization for the production of industrial crops and to take advantage of mechanization, drainage, and irrigation. The Republic Law has to be implemented through a Commune decision in which basic criteria are established for land and water use, which would require Vodostopanstvo to prepare an annual plan. This plan would provide for the rational use of land taking into consideration the layout of the irrigation network, the cropping pattern, crop rotation, water use, labor availability and requirements, mechanization and arrangements for the disposition of agriculture products, considering the capacities of processing facilities and local and external markets. During negotiations, assurances were obtained that the land use procedures outlined in paras. 5.14 through 5.17 would be followed.

VI. MARKET PROSPECTS, PROCESSING, FARM INCOMES AND PROJECT CHARGES

A. Market Prospects and Processing Requirements

6.01 The changes in output of agricultural production which will result from the provision of irrigation water to project area farmers are consistent

with the projected changes in demand for agricultural produce which accompany rising disposable income in Yugoslavia, with goals of agricultural self-sufficiency at the Republic and national levels and with projected export demand. Also, increased production will permit the fuller utilization of processing facilities already in place which serve the project area (para 2.09). At the same time, the incremental output from the project area at full development would not have a material impact on Yugoslavia's total agricultural product. Tobacco at 3.5% and sugar at 2.5% of respective national totals are the only processed crops for which Bitola Commune will account for more than 1.0% of Yugoslavia's projected 1985 production. Macedonia accounts for higher proportions of Yugoslavia's fresh fruit production, and marketing channels are well developed with nearby importing countries. No significant marketing problems are expected to constrain the growth projected with the project. However, certain investments in processing and related activities would be required to cope with the increase in project area production, and during negotiations the SRM ensured that the finance required for complementary investments at the farm level and in transport and processing would be made available to implement the project (Annex 1, Table 13).

6.02 Crop production is highly diversified in the project area. Purely industrial crops include sugarbeet, oilseeds and tobacco. Other categories consist of cereals, vegetables, fruit and livestock products.

Sugarbeet production in project area will increase by 7.5 times over the project development period. The sugar mill in Bitola will double its capacity to 300,000 tons of beet, which exceed the output projected for the project. Yugoslavia, currently an importer of sugar, is expected to reach self-sufficiency in sugar by 1980, and projected increases in production after 1980 are expected to balance growth in domestic consumption.

Oilseed production is expected to increase by 28% over the project development period. Output will be purchased by the processing plant in Titov Veles which in 1977 achieved a capacity utilization factor of only 70%. Project area volume at full development would equal about 15% of the factory's present capacity. Yugoslavia is expected to remain a net importer of vegetable oil until about 1980, following which production is expected to increase at approximately the same rate as domestic demand.

Tobacco production is expected to increase nine-fold under the project. Jugotutun, the tobacco monopoly, has a processing plant in Bitola which prepares the small leaf crop for other factories which manufacture tobacco products for domestic consumption and export. Yugoslav domestic sales and exports of tobacco are projected to increase at a rate which will accommodate fully the incremental production of the project area, and the plant in Bitola will expand its capacity by one-third by 1985 and by an additional 88% as required.

6.03 Cereals production will change greatly in composition. Wheat output will decline to a level determined by its usefulness in a rotation with sugarbeet, and all output, as at appraisal, will be processed locally. Barley will be phased out altogether. Maize production will increase, but at full development Bitola Commune will remain a maize deficit area.

Vegetable production is projected to increase by 82,095 tons during project development. Output will be diversified in terms of variety and seasonal availability. On-farm consumption is expected to increase, and consumers will find a varied selection of vegetables available in the local market. Incremental output under the project will provide the basis for rejuvination of the vegetable processing industry in Bitola. The local canning factory operated at about two-thirds of its 16,000 ton capacity in the mid-1970's, and obtained raw materials from as far as 150 km from Botola. It plans to undertake modernization and expansion of 50,000 tons capacity to accomodate increased local output. Management expects these changes to occur under a revised structure resulting from a merger with ZIK Pelagonija. The canning factory has export links with West Germany and other countries, and its expansion is consistent with Macedonian Government projections of national and export demand for its products. Fruit production will pass through the same channels as vegetables, and in addition supply the Lozar winery, which plans to expand its activities to include frozen fruit. Its wine making capacity will expand almost four-fold to accommodate increased production from the project and other areas and a fruit juice factory is foreseen whose construction is contingent upon a dependable water supply, which would be provided with the project. Yugoslavia is an exporter of wines and fresh fruit, and its export volume is expected to increase over the development of the project. Domestic consumption is projected to increase by more than 5% per annum.

6.04 Livestock production is expected to expand under the project, primarily in the form of dairying. Irrigation will permit sizeable increases in fodder production and in the availability of by-products suitable for consumption by livestock. The animal feedmill capacity would be almost doubled from 45,000 to 80,000 tons. Output of milk and milk products is expected to triple. This level of production requires the expansion of dairy processing capacity in Bitola. Discussions were underway in 1977 regarding the replacement of the presently outmoded 4,000 ton dairy by a plant with a capacity of 30,000 tons annually. Macedonia is not likely to achieve self-sufficiency in milk production for quite some time to come, and Yugoslavia will become self-sufficiency only in mid-1980's. Yugoslavia is also a net importer of meat. Meat production is projected to increase by 2.4 times under the project, and at full development output is expected to supply less than half of the raw material requirement of the present slaughtering facilities in Biotla. New slaughterhouse with processing facilities is under construction 140 kilometers from Bitola, which could, if necessary, absorb all the animal production from the project.

B. Farm Incomes

6.05 There are 5,500 farms in the individual sector. Farm budgets have been prepared for the eight representative model farms, based on the farm size distribution. Farm sizes, number and major operation under irrigation are as listed below:

Farm Model	Farm Size	Number of Farms	% of Holdings	Major Operation
Farm A	0.8 ha	1,500	27%	Tobacco/Vegetables
Farm B	0.8 ha	1,000	18%	Vegetables
Farm C	1.75 ha	1,000	18%	Tobacco/Vegetables
Farm D	1.75 ha	700	13%	Vegetables/Tobacco
Farm E	3.5 ha	400	7%	Vegetable/Dairy
Farm F	3.5 ha	400	7%	Industrial Crop/Fruit
Farm G	6.0 ha	200	4%	Industrial Crop/Fruit
Farm H	6.0 ha	300	6%	Vegetable/Fruit

6.06 Under the present rainfed conditions, farmers' opportunities for specialization are restricted. Therefore, present cropping pattern for farms of the same size are assumed to be identical, except for 6.0 ha farms. The present cropping pattern for the 6.0 ha farms are differentiated depending on whether they carry on dairy operations (Farm G) or not (Farm H). The future cropping pattern without project is expected to remain the same as at present. The cropping patterns at present, in future, with and without project for each model farm are given in Annex 1, Table 14. The total dairy cow holdings of individual sector farmers in the projet area would increase from 1600 at present to 3200. The increase is expected to be achieved under Farm Model E (from 300 heads to 700 heads on 400 farms) and under Farm Model G (from 800 heads to 2000 heads on 200 farms). No changes in sheep holdings are expected.

6.07 The average size of farm households in the project area is about six and does not vary much depending on farm size. Labor use profiles were constructed for each of the eight models, and indicate that the farms represented by the four smallest models would provide a labor surplus available for employment at peak periods on the four largest types of farms. Hired labor is costed at market wages of Din 150 per day.

6.08 Under full development, water charges for irrigation are expected to be Din 6,680/ha (US$370) at the January, 1978 price level (para 6.16).

6.09 The results of farm budget analysis are summarized in Table 6.1 and details are given in Annex 1, Table 15. The present agricultural income for farmers ranges from Din 10,340 (US$570) for a 0.8 ha farm to Din 51,100 (US$2,840) for a 6.0 ha farm with dairy operations. The average agricultural income per capita amounts to Din 2,350 (US$130). Agricultural income constitutes only 30% to 40% of the total income for families on small farms while families on large farms derive most of their income from agriculture. The average income of the farmers consists of about 50% from their own land, and the rest from outside employment. Thus, the average income per capita of the individual farmer was about Din 4,700 (US$260) in 1976. It is estimated that 80-90% of the individual farmers earn less than the relative poverty level (US$350 in 1976 dollars for Yugoslavia).

Table 6.1: SUMMARY FARM BUDGETS

Farm Model	Farm Incomes				Per Capita	
	Present	Future	Present	Future	Present	Future
	----- Din	------	---------- US$		----------	
Farm A (0.8 ha)	10,340	39,010	570	2,170	100	360
Farm B (0.8 ha)	10,340	33,360	570	1,850	100	310
Farm C (1.75 ha)	11,390	68,150	630	3,790	110	630
Farm D (1.75 ha)	11,390	76,680	630	4,260	110	710
Farm E (3.5 ha)	18,190	67,110	1,010	3,730	170	620
Farm F (3.5 ha)	18,190	106,210	1,010	5,900	170	980
Farm G (6.0 ha)	51,100	184,060	2,840	10,230	470	1,700
Farm H (6.0 ha)	38,000	175,350	2,110	9,740	350	1,620

6.10 With the full development of the project, the average agricultural income per capita would increase to Din 11,200 (US$620) from the present level of Din 2,350 (US$130). Assuming no changes in off-farm employment opportunities, the average income from all sources for individual sector farmers would be Din 13,500 (US$750). Most of the farmers with holdings of 1 ha or more earn substantially more than the relative poverty level. For the two smallest model farms of 0.8 ha holdings (Models A & B), the effect of the project on agricultural income is also significant. Agricultural income per capital would increase from Din 1,720 (US$100) to Din 6,500 (US$360) for Farm A (260%) and Din 5,560 (US$310) for Farm B (200%). Assuming no changes in off-farm employment opportunities, the earnings per capita of Farms A from all sources would reach US$510 (100% increase) and B would reach US$460 (80% increase). At full development, about 5% to 15% of the individual sector farmers would remain below the relative poverty level.

6.11 In the social sector, virtually all of the land is operated by a single agroindustrial kombinat, ZIK Pelagonija. The average per capita income for ZIK workers was approximately US$580 in 1976 and few earn less than the relative poverty level. With the project, the net income from agricultural production for ZIK is expected to grow from Din 62 million to Din 250 million at full development. As a result of the project, the wages for ZIK workers are expected to increase substantially. ZIK is a diversified agroindustry kombinat, whose workers' wages are determined not only by agricultural production but also by earnings of its other agroindustry operations. Although the above fact makes the estimate of future wages difficult, the average wage could be at least double the present level of US$580. All the ZIK workers would earn substantially more than the relative poverty level at full development.

C. Project Charges and Cost Recovery

6.12 Proposed Water Charges. Users of the water of the three project components, i.e., farmers, Bitola Water Authority (Vodovod) and thermal power plant (Electrostopanstvo), agreed through a series of water user agreements

on a system of water charges. These charges were negotiated among all parties concerned, with village assemblies representing farmers, and appear to be based on ability-to-pay criteria as well as a concern that construction, operation and maintenance costs of the system be borne largely by direct beneficiaries. For irrigation, the average rate of Din 2/m3 at full development is agreed by Yugoslav parties involved in the project. Since the estimated cost of equipping and monitoring all farmers with individual meters is prohibitive, it has been decided that farmers would pay differentiated per hectare charges based on water requirements calculated for their crops. This is common practice in Yugoslavia, and provides an equitable mechanism of cost sharing when individual meters are not available. It has also been agreed that the irrigation charges would be gradually increased to the full development level in order to alleviate the financial burden of farmers during the early years of operations as farmers move towards full development. Even though farmers in both sectors are expected to pay the same charges at full development, the charges during the phasing-in period for the individual sector farmers will start at a lower level and increase at a slower rate. Full water rates would not be implemented before 1986, and based on 1978 cost and price projections, they would be reached about 1987 for the social sector and 1989 for the individual sector. The actual dates and phasing would be determined on the basis of annual water charge reviews to be undertaken by Vodostopanstvo. The finalization of the water user agreements would be a condition of effectiveness. As shown in Annex 1, Table 5, the initial level of irrigation water charges causes operational deficits to Vodostopanstvo during the first four years of operations. The Commune of Bitola and SRM would cover such operational deficits through the provision of additional funds on terms and conditions acceptable to the Bank (para. 4.03).

6.13 Based on the average water requirements of 3,850 m3/ha for the social sector and 3,340 m3/ha for the individual sector, irrigation charges at full development would be Din 7,700/ha for the social sector and Din 6,680/ha for the individual sector. Electrostopanstvo has guaranteed to purchase 12 million m3 per year at Din 8.12/m3. On the other hand, water sales to Vodovod would depend on the demand for potable water. The proposed rates for this component are Din 4/m3 for domestic users and Din 8/m3 for industrial and institutional users. During negotiations, assurances were obtained that the water charges listed in paras 6.12 and 6.13, beginning in 1980 for supply of water to the thermal power plant and in 1982 for all other uses would be effective.

6.14 In order to evaluate the adequacy of the proposed project charges, two indices have been used which are defined as follows for this project.

(a) Cost recovery index. The ratio of the present value of water charges to be paid by project water users to the present value of project investment, operation and maintenance costs.

(b) Project Charges/Incremental Benefits Ratio. The ratio of the present value of water charges to be paid by farmers to the present value of incremental income accruing to farmers. All project charges, costs and benefits in 1978 constant dinar are discounted at 10% over the 60-year life of the project.

Table 6.2 Project Charges/Incremental Benefits Ratio

	0.8 ha Farm		1.75 ha Farm		3.50 ha Farm		6 ha Farm	
	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F	Farm G	Farm H
	Din							
At Full Project Development								
Cash Income (After Taxes)								
Present	10,340	10,340	11,390	11,390	18,190	18,190	51,100	38,000
Future without project	12,360	12,360	13,450	13,450	20,420	20,420	53,750	43,260
Future with project (before water charge)	44,350	38,700	79,840	88,370	90,490	129,590	224,140	215,430
Incremental cash income	31,990	26,340	66,390	74,920	70,070	109,170	170,390	172,170
Water Charges	5,340	5,340	11,690	11,690	23,380	23,380	40,080	40,080
Project Charges/Incremental Benefits Ratio	17%	20%	18%	16%	33%	21%	24%	23%
Discounted At 10% Over the Life of the Project								
Incremental Cash Income	175,650	141,660	360,380	403,810	345,600	504,740	689,100	768,260
Water Charges 1/	26,200	26,200	57,300	57,300	114,500	114,500	196,390	196,390
Project Charges/Incremental Benefits Ratio	15%	18%	16%	14%	33%	23%	28%	26%
Estimated Rent Recovery Index 2/	25%	31%	29%	28%	79%	40%	70%	46%

1/ Average Full Development Rate.
2/ Using conventional project criteria for quantifying returns to risk, management and return on investment.

July 1978

6.15 Cost Recovery Analysis. The summary of cost recovery analysis is given in Annex 1, Table 16. The construction cost of Din 2,597 million (base cost plus physical contingencies) and annual O&M costs of Din 42 million are charged against the project. The present value of construction and O&M costs discounted at 10% is Din 2,336 million. At the full development level starting in 1989, the water charges from irrigation would be Din 145.3 million annually. Water charges from the town water supply component would expand through 2001 with population growth and economic activity in the area served. Water charges projected for 2001 are Din 128.2 million in 1978 values. The water charges from the thermal power plant would remain Din 74.3 million throughout the life of the project. The present value of total charges is Din 2,132 million, 36% of which comes from sale of irrigation water, 35% from sale of water to the thermal power plant and 29% from sale of water to Commune of Bitola. The cost recovery index for the whole project is 91%. As for the irrigation component alone, the proposed charges would enable Vodostopanstvo to recover 100% of O&M costs and 28% of the capital investment costs over the life of the project.

6.16 Project Charges/Incremental Benefits Ratio Analysis. The project charges/incremental benefits ratios have been calculated for the eight model farms. The results are given in Table 6.2, showing the ratios ranging from 14% (Farm D) to 33% (Farm E). The two analyses, cost recovery analysis and project charges/incremental benefits ratio analysis indicate that the proposed average water charges are reasonable for the following reasons:

(a) Vodostopanstvo can recover a reasonable portion of the project costs;

(b) the level of water charges seems to be in line with the farmers' ability to pay;

(c) the larger farmers (Model E, F, G, H) pay out a higher proportion of their incremental income for water charges compared with smaller farmers (Model A, B, C, D), which appears to be consistent with equity consideration.

An assurance was obtained during negotiation that these analyses should be revised by Vodostopanstvo prior to the first water, incorporating up-to-date information, so that water rate or other adjustments could be recommended if necessary, especially as related to cropping patterns.

VII. BENEFITS, JUSTIFICATION AND RISKS

A. Benefits and Justification

7.01 The proposed project would increase yields and permit a more productive cropping pattern to be implemented on 20,300 ha through irrigation and land development. It would directly benefit approximately 5,500 individual

farm families operating their own holdings whose average per capita incomes are expected to expand by orders ranging from 2.6 to 6.4 times (paras. 6.12-6.13), and about 3,600 families deriving a major source of income from employment in social sector agribusiness. These direct beneficiaries would number about 50,000. The project would contribute to the realization of self-sufficiency objectives for major crops. The project area is depressed relatively to the average for Macedonia, which is one of the less developed parts of Yugoslavia. Construction of the project will create considerable employment, and the production possibilities it will offer when in operation create a permanent increase in opportunities for gainful occupation in the project area. The project cost per hectare is US$6,012, excluding price contingencies, which compares favorably with Bank financed investment in irrigation in other parts of Yugoslavia.

7.02 Estimated pre-project and full development yields and production are presented in Chapter V. Financial prices used in appraisal are those prevailing at the start of 1978. With minor exceptions, projected economic farm gate prices were obtained by adjusting financial prices, using individual factors for each input and produce category, based on opportunity costs, taxation and subsidies, and other values as appropriate. Traded agricultural produce (wheat, maize, sunflower, soyabeans, sugar beet, milk and meat) is valued at the border price. Where IBRD commodity price projections are available, border prices through 1985 are used, expressed in January 1978 Dinars. Post 1985 economic prices are expected to be equal to those prevailing in 1985. Where no such projections are used, the January 1978 border price is projected to apply over the life of the project. Input prices were determined as follows: seed costs were expected to alter in the same manner as relevant produce prices. Fertilizer was converted to a border price to reflect a 20% subsidy on imports, and projected through 1985 on the basis of IBRD projections. Pesticide and herbicide financial prices did not require adjustment, and were projected as being stable in constant Dinar terms over the life of the project. Labor costs are projected to remain constant in real terms. Social sector labor costs were deflated by 0.83 to reflect tax levels of 45% (1/1.45 = .69). Family labor in the individual sector was valued at its opportunity cost, Din 120 per day the going casual wage rate, in January 1978 dinars. Hired labor in the individual sector was valued at its financial cost, which is also its opportunity cost.

7.03 Using this data, a with vs. without project comparison was constructed for agriculture in the project area on the assumption that productivity without the project would remain constant, except for an increase of 2% annually based on historical experience and reasonable expectations, with respect to arable enterprises in the individual sector over the project development period. The incremental net benefit stream from agriculture before water charges was used as an input into rate of return calculations.

7.04 Flood control benefis will accrue under the project. However, the incremental level of such benefits is negligible because present earthworks and canalization of the major rivers provide adequate protection against

high water in an estimated 49 years out of 50. Under the project the level of protection would be raised to an estimated 99 years out of 100. Given the small incremental and the speculative nature of such projections, analytical economy was served by inserting a nominal value for flood control into the incremental benefit stream. The value selected, Din 6 million annually, or about 1% of the annual incremental net benefit from arable crop production at full development.

7.05 Income from the sale of bulk water to the thermal power plant and to the Bitola town water authority, has been included in the benefit stream net of imputed delivery costs through non-project systems to points of final use. These elements were analyzed separately in project preparation and against least cost alternatives yielded returns of more than 100% and 12% respectively.

7.06 The project cost streams include construction, operation and maintenance of the irrigation system, and agricultural services such as extension. Construction costs shown are net of price contingencies and deflated by 0.925, reflecting taxes. Other costs have been deflated by this factor and by the factor applied to social sector wages (0.83), as appropriate.

7.07 The most probable economic rate of return projected for the project is 15%. This estimate is not greatly sensitive to moderate changes in any of the component streams shown in Annex 1, Table 16, as indicated by the following sensitivity manipulations:

(a) one year delay in realization of revenues -- 13%

(b) one year delay in realization of agricultural revenues -- 14%

(c) 10% increase in cost streams -- 14%

(d) 20% increase in cost streams -- 13%

(e) 10% decrease in revenue streams -- 14%

(f) 20% decrease in revenue streams -- 12%

(g) 10% increase in costs accompanied by a 10% decrease in revenue -- 13%

(h) before revenues from sale of bulk water -- 11%

B. Risks and Uncertainty

7.08 Institutional Uncertainties. Vodostopanstvo has not previously shouldered responsibilities on the scale involved in the project. Teething problems will be encountered, but these are not expected to have a materially adverse impact on the projected rate of return. Special risks associated with construction are identified below. Land use rationalization (para. 5.14)

appears to be the best alternative, in the sense of optimizing production within the local preference for voluntary behavior as a means of organizing for water use. The local authorities concerned were of the view that no special enforcement measures would be required to secure the projected yield increases and an efficient cropping pattern on privately owned land in the project area. However, the existence of the project and the necessity of imposing water charges on a per hectare basis would increase the risks of individual farmers who because of age, infirmity, an inability to attract hired labor, or a preoccupation with non-farm interests might not be in a position to achieve projected agricultural yield increases. Speeding up the pace of agricultural advance, the project increases the risks of marginal farmers by increasing their costs of production through water charges. The representative farm budget models for individual farmers show that, on average, they would be able to improve their productivity sufficient to cover the additional costs and earn a reasonable return on their investment. Farmers not able to keep pace would under the land use law be required to relinquish operating control over their holdings to the social sector or to others in a position to achieve the yields required for viability, and under these circumstances, farmers may be compensated on fixed or share rent basis.

7.09 Financial Uncertainties. The risk of cost overruns as a result of unforeseen engineering problems is covered by a physical contingency allowance on top of the overall base cost estimate. A price contingency allowance of 21% has been added to base cost and physical contingency estimates. The financing risk consists of cost overruns which could occur if the four year construction schedule is not met, but the cost overrun guarantee from SBS and the special efforts to the republic authorities to obtain all necessary funds represent adequate assurances that funds would be most likely to be provided without undue delays.

7.10 Construction Risks. The construction timing risk is largely contained by an accelerated pace of tasks which are preliminary to construction work, and by advance contracting of critical components which must be completed in 1978 to ensure a four-year construction period. All feasible and reasonable attempts have been made to contain this risk; progress towards this goal have been satisfactory to date. The progress being made in these critical procurement operations is satisfactory.

7.11 Production Uncertainties. Production possibilities in the project area are sufficiently diversified and the infrastructure sufficiently developed that there is no material risk attached to securing the projected yield increases and a change to higher value crops consistent with appraisal projections.

7.12 Marketing Uncertainties. While local bottlenecks in the marketing chain may from time to time appear, these are likely to be temporary difficulties in phasing rather than basic gaps in system performance. Marketing problems (including price problems) are not expected to depress materially the rate of return projected for the project.

7.13 In considering the importance of agriculture in the economy, the risks involved in the project are worth taking.

VIII. RECOMMENDATIONS

8.01 Assurances were obtained from:

The SR Macedonia Government that:

(a) BOAL Strezevo would receive the first quarterly installment of grants and equity subscription (para 3.09) by December 31, 1978;

(b) SRM and Bitola Commune would provide funds to cover the financial deficit of Vodostopanstvo BOAL Strezevo until it reaches self-sufficiency (para 4.03);

(c) Land and rights of way required for project construction and operation would be acquired in a timely manner (para 4.10);

(d) Land use rationalization would be undertaken throughout the life of the project to utilize the irrigation system efficiently (para 5.17);

Stopanska Banka Skopje that:

(e) SBS would, after completion of the project, prepare a report on the execution and initial operation of the project, its costs, the benefits derived from the project and the performance of the lending institutions not later than December 31, 1983 (para 3.18);

Vodostopanstvo that:

(f) The project would be carried out as defined according to detailed features (para 3.02);

(g) A specialized consultant would be employed to review the design of the irrigation network (para 3.05);

(h) Vodostopanstvo would appoint a financial director and a director for BOAL Strezevo, both appropriately qualified and acceptable to the Bank, prior to effectiveness; and the BOAL Strezevo would be adequately organized and staffed for efficient operation of the project facilities (paras 3.16 and 4.03);

(i) BOAL Strezevo would be established prior to effectiveness for the sole purpose of project implementation and operation (para. 4.03);

(j) BOAL Strezevo would prepare annually a plan for the operation of the irrigation system, and by 1980 submit to the Bank a detailed plan governing the ownership, operation and replacement of portable farm equipment in the individual sector (para 4.07);

(l) Minimum charges for irrigation water and for water sold to the thermal power plant and the town of Bitola would be according to rates specified at appraisal (para 6.13);

(k) Cost recovery analysis will be undertaken prior to first water so that water rate on other adjustments may be recommended for the consideration of parties to self-management agreements governing water rates and other charges (para. 6.16).

8.02 With the above assurances, the proposed project is suitable for a Bank loan of US$82 million for a period of 15 years including 3 years of grace to the Stopanska Banka with the guarantee of the Socialist Republic of Yugoslavia.

ANNEX 1

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Supporting Tables

February 1978

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Climatic Data

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	
Average Bitola Rainfall	mm /a	59	47	56	34	65	37	35	31	32	53	77	61	586
Average Novaci Rainfall	mm /a	54	44	50	37	61	41	29	23	33	46	67	54	539
Bitola Monthly Temperature	°C /a	-0.3	2.1	5.7	11.2	15.8	19.7	22.1	22.0	17.7	11.8	7.2	2.2	
Bitola Relative Humidity	% /a	84	78	72	65	66	61	55	54	63	74	81	84	
Bitola 13.00 hrs Rel. Hum.	% /b	69	71	69	49	60	50	45	45	50	53	74	80	
Bitola Cloud Cover	% /b	40	49	54	39	53	46	45	36	49	51	56	62	
Bitola Average Wind	m/sec /a	-	-	-	----------	----------	1.3 m/sec daily average		----------		-	-	-	
13.00 hrs Average Wind	m/sec /b	1.7	1.7	3.0	4.4	2.5	2.7	3.1	3.1	2.8	3.6	2.6	3.0	
Block in FAO Paper No. 24, p 14	/c	IX	IX	IX	VIII, IX V, VI	VIII, IX	VIII, IX V, VI	VIII, V	VIII, V	VIII, IX	IX	IX	IX	
ETo	mm/day /d	0	0.2	1.0	2.6	3.2	4.6	5.5	5.1	3.0	1.4	0.7	0	
ETo	mm/month	0	6	31	78	99	138	171	158	90	43	21	0	835
Class A pan x 0.70 (1958-1973)	mm/month	ice	ice	ice	75	103	126	153	149	91	54	ice	ice	751
Bitola Average Absolute Minimum Temperature	°C /a	-14.7	-12.3	-6.8	-0.9	2.3	6.3	8.3	7.5	3.0	-1.1	-5.5	-10.4	
Bitola Average Absolute Maximum Temperature	°C /a	12.8	15.5	19.8	23.8	28.7	32.8	33.0	35.6	31.7	25.8	19.4	15.0	

/a 22 year average. Bitola located at 41° N, 21° E, elevation 600.

/b Typical observations - 1964.

/c Used to compute Blaney and Criddle.

/d By Blaney and Criddle method.

January 1978

ANNEX 1
Table 1

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA[1/]

Cost Estimate

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange %
	------Din Million--------			------US$million-------			
Civil Works							
Strezevo Dam	334.4	273.6	608.0	18.6	15.2	33.8	45
Alimentation Canal	168.6	69.0	237.6	9.4	3.8	13.2	29
Main Canal	258.3	105.5	363.8	14.3	5.9	20.2	29
Irrigation Network	321.6	285.1	606.7	17.9	15.8	33.7	47
Power Plant Supply	10.6	24.7	35.3	0.6	1.4	2.0	70
Buildings	9.4	1.5	10.9	0.5	0.1	0.6	14
Subtotal	1102.9	759.4	1862.3	61.3	42.2	103.5	41
Equipment							
Stezevo Dam	7.2	16.9	24.1	0.4	0.9	1.3	70
Alimentation Canal	0.5	1.2	1.7	-	0.1	0.1	70
Main Canal	3.0	6.8	9.8	0.2	0.4	0.6	70
Hydrants	12.8	29.9	42.7	0.7	1.7	2.4	70
Sprinkler Equipment	60.3	111.6	171.9	3.3	6.1	9.4	65
Telecommunications	1.3	2.9	4.2	0.1	0.2	0.3	70
Vehicles	1.3	2.9	4.2	0.1	0.2	0.3	70
Subtotal	86.4	172.2	258.6	4.8	9.6	14.4	67
Land Compensation							
Strezevo Dam	82.4	-	82.4	4.6	-	4.6	-
Alimentation Canal	1.6	-	1.6	0.1	-	0.1	-
Main Canal	3.8	-	3.8	0.2	-	0.2	-
Irrigation Network	45.6	-	45.6	2.5	-	2.5	-
Subtotal	133.4		133.4	7.4		7.4	
Administration & Eng.							
Strezevo Dam	38.2	-	38.2	2.1	-	2.1	-
Alimentation Canal	15.1	-	15.1	0.8	-	0.8	-
Main Canal	21.3	-	21.3	1.2	-	1.2	-
Network (local)	34.3	-	34.3	2.0	-	2.0	-
Network (Foreign)	-	2.2	2.2	-	0.1	0.1	100
Power Plant Supply	2.4	-	2.4	0.1	-	0.1	-
Subtotal	111.3	2.2	113.5	6.7	0.1	6.3	1
Base Cost Estimate	1434.0	933.8	2367.8	79.7	51.9	131.6	39
Physical Contingency 2/ (On Civil Works & Equip.)	127.8	101.8	229.6	7.1	5.7	12.8	44
Price Contingency 3/	332.6	208.4	541.0	18.5	11.5	30.0	39
Total Project Cost 4/	1894.4	1244.0	3138.4	105.3	69.1	174.4	40
Irrigation Feasibility Studies	16.2	10.8	27.0	0.9	0.6	1.5	40

1/ Discrepancies due to rounding.

2/ Physical Contingencies are estimated at 15% for Dam, 10% for Civil Works and 5% for materials and equipment.

3/ Price Contingencies are:

	1978-79	1980-81
Civil Works	10.0%	10.0%
Equipment	7.5	7.0

4/ Cost estimate includes taxes and duties of about US$13 million.

January 1978

ANNEX 1
Table 3

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Schedule of Expenditure

	Total		1978		1979		1980		1981		Foreign Exchange
	Foreign	Total	Foreign	Total	Foreign	Total	Foreign	Total	Foreign	Total	%
	Din million										
Civil Works											
Strezevo Dam	273.6	608.0	54.7	121.6	68.5	152.3	95.8	212.8	54.6	121.3	45
Alimentation Canal	69.0	237.6	6.9	23.7	24.1	83.1	20.7	71.3	17.3	59.5	29
Main Canal	105.5	363.8	9.0	31.2	42.9	147.8	32.2	110.9	21.4	73.9	29
Irrigation Netowrk	285.1	606.7	57.1	121.4	91.2	194.1	85.5	182.0	51.3	109.2	47
Power Plant Supply	24.7	35.3	12.8	18.3	11.9	17.0	-	-	-	-	70
Buildings	1.5	10.9	0.7	5.4	0.8	5.5	-	-	-	-	14
Subtotal	759.4	1862.3	141.2	321.6	239.4	599.8	234.2	577.0	144.6	363.9	41
Price Contingency	165.1	409.9	7.1	16.1	37.1	93.0	63.4	156.1	57.5	144.7	40
Total	924.5	2272.2	148.3	337.7	276.5	692.8	297.6	733.1	202.1	508.6	41
Materials & Equipment											
Strezevo Dam	16.9	24.1	3.4	4.8	3.4	4.9	5.9	8.4	4.2	6.0	70
Alimentation Canal	1.2	1.7	0.1	0.2	0.3	0.4	0.4	0.5	0.4	0.6	70
Main Canal	6.8	9.8	0.7	1.0	1.3	1.9	2.1	3.0	2.7	3.9	70
Hydrants	29.9	42.7	29.9	42.7	-	-	-	-	-	-	70
Sprinkler equipment	111.6	171.9	44.7	68.8	22.3	34.3	22.3	34.5	22.3	34.3	65
Telecommunication	2.9	4.2	-	-	-	-	-	-	2.9	4.2	70
Vehicles	2.9	4.2	1.5	2.1	1.4	2.1	-	-	-	-	70
Subtotal	172.2	258.6	80.3	119.6	28.7	43.6	30.7	46.4	32.5	49.0	67
Price Contingency	21.5	32.3	3.0	4.5	3.3	5.0	6.1	9.1	9.1	13.7	67
Total	193.9	290.9	83.3	124.1	32.0	48.6	36.8	55.5	41.6	62.7	67
Land Compensation											
Strezevo Dam	-	82.4	-	31.8	-	31.8	-	10.6	-	8.2	-
Alimentation Canal	-	1.6	-	0.2	-	0.4	-	0.5	-	0.5	-
Main Canal	-	3.8	-	0.4	-	0.7	-	1.2	-	1.5	-
Irrigation Network	-	45.6	-	9.1	-	19.1	-	15.9	-	1.5	-
Subtotal	-	133.4	-	41.5	-	52.0	-	28.2	-	11.7	-
Price Contingency	-	22.5	-	2.1	-	8.1	-	7.6	-	4.7	-
Total	-	155.9	-	43.6	-	60.1	-	35.8	-	16.4	-
Administration & Engineering											
Strezevo Dam	-	38.2	-	7.6	-	7.6	-	13.4	-	9.6	-
Alimentation Canal	-	15.1	-	1.5	-	3.8	-	4.6	-	5.2	-
Main Canal	-	21.3	-	2.1	-	4.2	-	6.4	-	8.6	-
Network (Local)	-	34.3	-	9.7	-	6.4	-	7.2	-	11.0	-
Network (Foreign)	2.2	2.2	1.1	1.1	1.1	1.1	-	-	-	-	100
Power Plant Supply	-	2.4	-	2.4	-	-	-	-	-	-	-
Subtotal	2.2	113.5	1.1	24.4	1.1	23.1	-	31.6	-	34.4	2
Price Contingency	0.3	26.8	0.1	1.5	0.2	3.5	-	8.5	-	13.6	1
Total	2.5	140.3	1.2	25.6	1.3	26.6	-	40.1	-	48.0	2
Physical Contingencies											
10% on Civil Works & Equipment	101.8	229.6	20.9	44.2	28.8	69.8	33.3	70.6	18.8	45.0	44
Price Contingency	21.5	49.5	1.0	2.1	4.4	10.8	8.9	19.0	7.2	17.6	45
Total	123.3	279.1	21.9	46.3	33.2	80.6	42.2	89.6	26.0	62.6	44
Grand Total	1244.0	3138.4	254.7	577.3	343.0	908.7	376.6	954.1	269.7	698.3	40
Total Contingencies	310.2	770.6	32.1	70.1	73.8	190.2	111.7	270.9	92.6	239.3	40
Total Price Contingencies	208.4	541.0	11.2	25.9	45.0	120.4	78.4	200.3	73.8	184.3	39
Irrigation Feasibility Studies	10.8	27.0	-	-	5.4	13.5	5.4	13.5	-	-	

Note 1: Discrepancies are due to rounding.
Note 2: Physical Contingencies are estimated at 15% for Dam, 10% for Civil Works and 5% for materials and equipment.
Note 3: Price Contingencies are:

	1978-79	1980-81
Civil Works	10.0%	10.0%
Equipment	7.5	7.0

Note 4: Cost estimate includes taxes and duties of about Din 235 million.

January 1978

ANNEX 1
Table 4

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Estimated Schedule of Disbursements

IBRD Fiscal Year and Quarter:	Cumulative Disbursements at End of Quarter: US$ Millions
1978/79	
September 30, 1978	2.0
December 31, 1978	6.0
March 31, 1979	9.5
June 30, 1979	14.5
1979/80	
September 30, 1979	18.0
December 31, 1979	22.5
March 31, 1980	29.0
June 30, 1980	37.5
1980/81	
September 30, 1980	42.5
December 31, 1980	48.5
March 31, 1981	54.5
June 30, 1981	62.5
1981/82	
September 30, 1981	67.0
December 31, 1981	71.5
March 31, 1982	76.3
June 30, 1982	80.5
1982/83	
September 30, 1982	81.5
December 31, 1982	82.0

January 1978

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Vodostopanstvo BOAL "Strezevo" - Cash Flow Statement

	Total During Construction Period	Construction Period 1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	Million Dinar													
APPLICATION OF FUNDS														
Project Investment Cost	3,138	577	909	954	698	-	-	-	-	-	-	-	-	-
Financial Charges during Grace Period	368	26	64	115	163	-	-	-	-	-	-	-	-	-
Debt Service:														
(a) IBRD Loan	62	-	-	-	62	241	230	221	210	200	189	179	169	158
(b) Stopanska Banka Loan (@4.2%)	-	-	-	-	-	105	105	105	105	105	105	105	105	105
(c) Other Local Bank Loan	-	-	-	-	-	59	58	59	58	59	58	-	-	-
Total Applications	3,568	603	973	1,069	923	405	393	385	373	364	352	284	274	263
SOURCES OF FUNDS														
Water Charges														
(a) Irrigation	-	-	-	-	-	70	93	128	162	211	271	304	342	364
(b) Town Water Supply	-	-	-	-	-	84	96	106	119	133	148	165	178	203
(c) Thermal Power Plant	176	-	-	85	91	97	104	112	119	128	137	146	145	167
Total Revenue	176	-	-	85	91	251	293	346	400	472	556	615	665	734
Less Operation & Maintenance cost	(70)	(5)	(5)	(15)	(45)	(81)	(87)	(93)	(99)	(106)	(113)	(122)	(130)	(139)
Less Incremental Working Capital Requirement	(10)	(0)	(0)	(5)	(5)	(5)	(3)	(3)	(3)	(4)	(5)	(4)	(3)	(4)
Net Cash Generated from Operations	96	(5)	(5)	65	41	165	203	250	290	362	438	489	532	591
Grant from SR Macedonia	200	60	30	30	80	-	-	-	-	-	-	-	-	-
Equity contribution from Bitola enterprises	280	70	70	70	70	-	-	-	-	-	-	-	-	-
IBRD Loan plus local charges	1,491	249	404	454	384	-	-	-	-	-	-	-	-	-
Stopanska Banka Loan (Federal Fund)(4.2%)	1,204	160	415	370	259	-	-	-	-	-	-	-	-	-
Other Local bank loans	297	69	59	80	89	-	-	-	-	-	-	-	-	-
Total Sources	3,568	603	973	1,069	923	165	203	250	290	362	438	489	532	591
Surplus (Deficit)	-	-	-	-	-	(240)	(190)	(135)	(83)	(2)	86	205	258	328
Cumulative Surplus	-	-	-	-	-	(240)	(430)	(565)	(648)	(650)	(562)	(357)	(99)	229

NOTE: Assumptions for the financial projections are given in the Project File.

July 1978

ANNEX 1
Table 5

AFPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Inputs and Production Cost Per Hectare With Project

	Seeds Quantity Price Total Cost (Din)	Fertilizers Type	Fertilizers Quantity Price Total Cost (Din)	Pesticides Type	Pesticides Quantity Price Total Cost (Din)	Herbicides Type	Herbicides Quantity Price Total Cost (Din)	Machinery Service 1/	Hired Labor Mandays Din 150/day	Production Cost per ha (Din)
A. Social Sector										
Wheat	200 kg x 5 1,000	16-32-0 N27%	400 kg x 4 150 kg x 2 1,900	Lindan Ethiol 37	7 kg x 16 2 kg x 35 182	Dikuran Bonnel	2.5 kg x 200 50 kg x 4 700	3,654	4.5 days 675 Din	7,211
Maize	30 kg x 30 900	10-32-20 N27% Manure 10,000 kg/1,200 Din	450 kg x 4 200 kg x 2 34,000	Lindan Dehereban	7 kg x 16 2 kg x 40 192		0	3,360	16 days 2,400 Din	10,252
Sugar beet	5 kg x 360 1,800	14-14-14 Manure	800 kg x 3 10,000 kg 3,600	Volatan G10 Phenitevtion Ultracid 40	15 kg x 37 15 kg x 81 1 kg x227 903	Ronet Betanol	5 kg x 190 6 kg x 187 2,072	5,017	34 days 5,100 Din	18,492
Sunflower	20 kg x 8 160	14-14-14 Manure	800 kg x 3 10,000 kg x 0.12 3,600	Lindan	7 kg x 16 112	Gezagard 50	2.5kg x 96 240	4,055	16 days 2,400 Din	10,567
Soyabeans	60 kg x 6 360	0-20-30 N27%	300 kg x 2.5 150 kg x 2 1,050	Lindan	7 kg x 16 112	Gezagard 50	2.5kg x 96 240	4,055	8 days 1,200 Din	7,017
Tobacco	Free of charge 0	10-30-20	600 kg x 4 2,400	Bakaren Cineb	36 kg x 21 18 kg x 36 1,404	Patorans 50	3 kg x 187 561	2,151	131 days 19,650 Din	26,166
Tomatoes (Industrial)	3 kg x 400 1,200	16-16-16 Manure	300 kg x 3.2 20,000 kg x 0.12 3,360	6 different pesticides amounting to	2,389	Devronil Cenkor	4.5kg x 240 0.5kg x 600 1,380	2,151	102 days 15,300	25,780
Pepper (Industrial)	5 kg = 1,250		3,360		2,200		1,350	2,151	133 days/ 19,950 Din	30,261
Onions	300 kg x 30 9,000	14-14-14 Manure	800 kg x 3 10,000 kg x 0.12 3,600		0		600	2,975	34 days 5,100	21,275
Alfalfa	40 kg x 40 Every 4 years 400	P_2O_5 45%	200 kg x 3.8 760		0	Eptan Aretit	2 kg x 155 3.5 kg x 65 537	5,198	10 days 1,500	8,704
Maize Silage	66 kg x 3 200	N27% P_2O_5 45%	370 kg x 2 200 kg x 3.8 1,500	Lindan Dehereban	7 kg x 16 2 kg x 40 192		0	4,671	4 days 600 Din	7,163
Fodder Peas	60 kg x 15 900	0-20-30- N27%	300 kg x 2.5 150 kg x 2 1,050	Lindan	7 kg x 16 112	Gezagard 50	2.5 kg x 96 240	4,671	4 days 600 Din	7,500
Orchards	0	0-20-30 N27%	600 kg x 2.5 600kg x 2 2,700	6 different pesticides amounting to	4,533		537	2,881	100 days 15,000 Din	25,651
Vineyards	0	10-32- 0 N27%	600 kg x 4 250 kg x 2 2,900	7 different pesticides amounting to	2,003		0	2,585	86 days 12,900	20,388
B. Private Sector										
Potatoes	2,000 kg x 5 10,000	10-30-20 N27%	800 kg x 3 150 kg x 2 2,700	Dithan	6 kg x 55 330	Ronet	2 kg x 190 380	5,017	20 days 3,000	21,427
Late Vegetables	3,000	14-14-14 Manure	800 kg x 3 10,000 kg x 0.12 3,600	Lindan	7 kg x 16 112	Gezagard 50	3 kg x 96 288	2,151	40 days 6,000	15,151
Winter Vegetables	3,000		3,600		112		288	2,151	20 days/ 3,000 Din	12,151

1/ Detailed machinery equipment costs in Project Files.

ANNEX 1
Table 6

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Present Costs and Income Per Hectare - Social Sector

Crop	Yield kg/ha	Price Per/kg (Din)	Gross Income Din/ha	Seeds Din/ha	Fertilizers Din/ha	Pesticides Herbicides Din/ha	Mechanization Din/ha	Hired Labor Din/ha	Production Cost Din/ha	Net Income Din/ha	Cultivated Hectares	Total Net Income (Din'000)
Wheat Grain	3,800	3.0	11,400	990	1,300	613	3,100	450	6,453	4,947	4,850	23,992
Straw	2,500	1/	-	-	-	-	-	-	-	-	-	-
Barley Grain	2,300	2.8	6,440	720	1,125	613	3,100	450	6,008	432	390	168
Straw	2,500	1/	-	-	-	-	-	-	-	-	-	-
Maize Grain	4,000	2.5	10,000	150	2,425	416	3,600	1,950	8,541	1,459	390	569
Sugar beet	32,000	0.58	18,560	1,800	2,500	2,570	4,730	3,600	15,200	3,360	780	2,621
Sugar beet tops	3,200	1/	-	-	-	-	-	-	-	-	-	-
Sunflower	1,500	5.5	8,250	96	2,000	400	3,270	1,050	6,816	1,434	2,520	3,614
Alfalfa (Hay)	5,000	1.8	9,000	400 2/	350	200	1,900	900	3,750	5,250	780	2,100 3/
Orchards	9,000	5.0	45,000	0 4/	2,000	3,000	2,400	8,000	15,400	29,600	80	2,368
Vineyards	4,000	5.0	20,000	0 4/	1,500	1,600	1,000	6,000	10,100	9,900	120	1,188
Meadows	3,500	1/	-	-	-	-	-	-	-	-	110	-
Pasture	900	1/	-	-	-	-	-	-	-	-	30	-
											10,050	36,620

1/ The following quantities of by-products and fodder crops are included in livestock models in the Project File.

Wheat straw	4,850 ha x 2.5 tons = 12,125 tons	Alfalfa hay	380 ha x 5.0 tons = 1,900 tons
Barley straw	390 ha x 2.5 tons = 975 tons	Meadows hay	110 ha x 3.5 tons = 385 tons
Sugar beet tops	780 ha x 3.2 tons = 2,496 tons	Pasture hay	30 ha x 0.9 tons = 27 tons

2/ Alfalfa seeds 40 kg x 40 Din = 1,600 Din spread over 4 years. Din 400/year.

3/ Out of 780 ha of alfalfa, production of 400 ha is sold to fodder plant (2.1 Million Din) and production of 380 ha for on-farm consumption.

4/ Old plantation to be renewed.

January 1978

ANNEX 1
Table 7

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Present Costs and Income Per Hectare - Individual Sector

Crop	Yield kg/ha	Price Per/kg/Din	Gross Income Din/ha	Seeds Din/ha	Fertilizer Din/ha	Pesticides Herbicides Din/ha	Mechanization Din/ha	Hired Labor Din/ha	Family Labor Manday/kg	Production Cost Din/ha	Net Income Din/ha	Cultivated hectares	Total Net Income (Din'000)
Wheat Grain	2,900	3.0	8,700	990	625	170	1,400	300	4	3,485	5,215	3,240	16,896
Straw	2,000	1/	-	-	-	-	-	-	-	-	-	-	-
Barley Grain	1,300	2.8	3,640	720	475	170	1,400	300	4	3,065	575	630	362
Straw	1,500	1/	-	-	-	-	-	-	-	-	-	-	-
Maize	2,100	2.5	5,250	150	1,950	216	600	1,000	10	3,916	1,334	630	1/
Sugar beet	25,000	0.58	14,500	0 2/	2,000	1,086	1,900	2,500	18	7,486	7,014	180	1,263
Sugar beet tops	2,500	1/	-	-	-	-	-	-	-	-	-	-	-
Sunflower	1,400	5.5	7,700	96	1,750	216	600	1,000	10	3,662	4,038	1,260	5,088
Tobacco	1,200	40.0	48,000	0 2/	1,100	1,400	800	3,000	50	6,300	41,700	270	11,259
Tomato(Indust.)	20,000	1.2	24,000	4,000	2,000	2,560	800	3,000	30	12,360	11,640	400	4,656
Tomato (Fresh)	15,000	3.5	52,500	4,000	2,000	2,560	800	3,000	30	12,360	40,140	150	6,021
Pepper (Indust.)	12,000	3.0	36,000	10,000	2,000	1,700	800	3,000	30	17,500	18,500	70	1,295
Pepper (Fresh)	8,000	5.0	40,000	10,000	2,000	1,700	800	3,000	30	17,500	22,500	30	675
Beans	1,000	10.0	10,000	1,500	1,000	600	800	500	5	4,400	5,600	100	560
Peas	1,500	7.0	10,500	1,000	1,000	600	800	500	5	3,900	6,600	100	660
Potatoes	12,000	4.0	48,000	10,000	2,000	2,560	800	3,000	40	18,360	29,640	100	2,964
Alfalfa (Hay)	4,000	1.8	7,200	400 3/	350	0	0	900	40	1,650	1/	320	0
Orchards	5,000	5.0	25,000	0 4/	1,500	2,300	0	4,000	40	7,800	17,200	320	5,504
Vineyards	1,500	5.0	7,500	0 4/	1,000	460	0	4,000	40	5,460	2,040	380	775
Meadows	2,000	1/										990	
Pasture	900	1/										470	
												9,640	57,978

1/ The following quantities of by-products and fodder crops are included in livestock models in the Project File.

Wheat straw	3,240 ha X 2 tons = 6,480 tons	Alfalfa hay	320 ha X 4.0 tons = 1,280 tons
Barley straw	630 ha X 1.5 tons = 945 tons	Meadow hay	990 ha X 2.0 tons = 1,980 tons
Sugar beet tops	180 ha X 4.0 tons = 450 tons	Pasture hay	470 ha X 0.9 tons = 423 tons

2/ Sugar beet and tobacco seeds provided by the factory free of charge.

3/ Alfalfa seeds 40 kg X 40 Din = 1,600 Din spread over 4 years. Din 400/year.

4/ Old plantations to be renewed.

January 1978

ANNEX 1
Table 8

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Present and Proposed Cropping Pattern Yields and Production

Crops	Social Sector							Private Sector							
	Area ha	Present Yield ton/ha	Production (tons)	Area ha	Future Yield ton/ha	Production (tons)	Incremental Production (tons)	Area Ha	Present Yield ton/ha	Production (tons)	Area ha	Future Yield ton/ha	Production (tons)	Incremental Production (tons)	Total Incremental Production (tons)
Wheat	4,850	3.8	18,430	2,500	5.5	13,750	(4.680)	3,240	2.9	9,396	2,150	4.0	8,600	(796)	(5,476)
Barley	390	2.3	897	-	-	-	(897)	630	1.3	819	-	-	-	(819)	(1,716)
Maize	390	4.0	1,560	900	7.0	6,300	4,740	630	2.1	1,323	750	5.5	4,125	2,802	7,542
Sugar beet	780	32.0	24,960	2,500	60.0	150,000	125,040	180	25.0	4,500	1,400	50.0	70,000	65,500	190,540
Sunflower	2,520	1.5	3,780	1,100	3.5	3,850	70	1,260	1.4	1,764	700	2.8	1,960	196	266
Soyabeans	-	-	-	250	2.5	625	625	-	-	-	300	2.2	660	660	1,285
Tobacco	-	-	-	200	2.5	500	500	270	1.2	324	1,100	2.2	2,420	2,096	2,596
Tomato (Industrial)	-	-	-	200	50.0	10,000	10,000	400	20.0	8,000	280	45.0	12,600	4,600	14,600
Tomato (Fresh)	-	-	-	-	-	-	-	150	15.0	2,250	300	30.0	9,000	6,750	6,750
Pepper (Industrial)	-	-	-	375	25.0	9,375	9,375	70	12.0	840	300	25.0	7,500	6,660	16,035
Peper (Fresh)	-	-	-	-	-	-	-	30	8.0	240	270	20.0	5,400	5,160	5,160
Beans	-	-	-	-	-	-	-	100	1.0	100	300	2.0	600	500	500
Peas	-	-	-	-	-	-	-	100	1.5	150	200	3.0	600	450	450
Potatoes	-	-	-	-	-	-	-	100	12.0	1,200	500	20.0	10,000	8,800	8,800
Late Vegetables	-	-	-	-	-	-	-	-	-	-	800	25.0	20,000	20,000	20,000
Onions	-	-	-	300	14.0	4,200	4,200	-	-	-	300	12.0	3,600	3,600	7,800
Winter Vegetables	-	-	-					-	-	-	200	10.0	2,000	2,000	2,000
Alfalfa	780	5.0	3,900	1,000	14.0	14,000	10,100	320	4.0	1,280	1,200	12.0	14,400	13,120	23,220
Maize Silage	-	-	-	2,500	40.0	100,000	100,000	-	-	-	500	35.0	17,500	17,500	117,500
Fodder Peas	-	-	-	1,350	30.0	40,500	40,500	-	-	-	1,150	25.0	28,750	28,750	69,250
Orchards	80	9.0	720	150	25.0	3,750	3,030	320	5.0	1,600	400	20.0	8,000	6,400	9,430
Vineyards	120	4.0	480	150	20.0	3,000	2,520	380	1.5	570	270	18.0	4,860	4,290	6,810
Grapes	-	-	-	-	-	-	-	-	-	-	190	16.0	3,040	3,040	3,040
Meadows	110	3.5	385	-	-	-	(385)	990	2.0	1,980	-	-	-	(1,980)	(2,365)
Pastures	30	0.9	27	-	-	-	(27)	470	0.9	423	-	-	-	(423)	(450)
Cropped Area	10,050		55,139	13,475		359,850	304,711	9,640		36,759	13,560		235,615	198,856	503,567
Land Area	10,350			9,500				10.800			10,800				
Cropping Intensity				141%							125%				

ANNEX 1
Table 9

January 1978

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Costs and Income per Hectare (Before Water Charges) - Social Sector With Project

Crop		Yield kg/ha	Price Per kg (Din)	Gross Income Din/ha	Seeds Din/ha	Fertilizers Din/ha	Pesticides Herbicides Din/	Machinery Equipment Din/ha	Hired Labor Din/ha	Product Cost Din/ha	Net Income Din/ha	Cultivated Hectares	Total Net Income Din'000
Wheat	Grain	5,500	3.0	16,500	1,000	1,900	882	3,654	675	7,211	9,289	2,500	23,222
	Straw	4,500	1/										
Maize	Grain	7,000	2.5	17,500	900	3,400	192	3,360	2,400	10,252	7,248	900	6,523
Sugar beet		60,000	0.58	34,800	1,800	3,600	2,975	5,017	5,100	18,492	16,308	2,500	40,770
Sugar beet tops		6,000	1/										
Sunflower		3,500	5.5	19,250	160	3,600	352	4,055	2,400	10,567	8,683	1,100	9,551
Soyabeans		2,500	5.5	13,750	360	1,050	352	4,055	1,200	7,017	6,733	250	1,683
Soyabeans straw		3,000	1/										
Tobacco (small leaves)		2,500	40.0	100,000	0 2/	2,400	1,965	2,151	19,650	26,166	73,834	200	14,766
Tomatoes (Industrial)		50,000	1.2	60,000	1,200	3,360	3,769	2,151	15,300	25,780	34,220	200	6,844
Pepper (Industrial)		25,000	3.0	75,000	1,250	3,360	3,550	2,151	19,950	30,261	44,739	375	16,777
Onions		14,000	6.0	84,000	9,000	3,600	600	2,975	5,100	21,275	62,725	300	18,817
Alfalfa (sold)		14,000	1.8	25,200	400 3/	760	537	5,198	1,500	8,704	16,496	600	9,897
Alfalfa (Consumed)		14,000	1/		400 3/	760	537	5,198	1,500	8,704		400	
Maize Silage		40,000	1/		200	1,500	192	4,671	600	7,163		2,500	
Fodder Peas		30,000	1/		900	1,050	289	4,671	600	7,510		1,350	
Orchards		25,000	5.0	125,000	0 4/	2,700	5,070	2,881	15,000	25,651	99,349	150	14,902
Vineyards		20,000	5.0	100,000	0 4/	2,900	2,003	2,585	12,900	20,388	79,612	150	11,941
												13,475	175,693

1/ The following quantities of by-products and fodder crops are included in livestock models in the Project File.

Wheat straw	2,500 ha	X 4.5	ton/ha	=	11,250 tons
Sugar beet top	2,500 ha	X 6	ton/ha	=	15,000 tons
Soyabean straw	250 ha	X 3	ton/ha	=	750 tons
Alfalfa consumed	400 ha	X 14	ton/ha	=	5,600 tons
Maize silage	2,500 ha	X 40	ton/ha	=	100,000 tons
Fodder peas	1,350 ha	X 30	ton/ha	=	40,500 tons

2/ Tobacco seeds provided by tobacco factory free of charge

3/ Alfalfa seeds 40 kg x 40 D = 1600 Din every 4 years or 400 Din per year.

4/ Investment for orchards (80,500 D/ha) and vineyards (84,500 D/ha) are taken into account in the Economic Analysis, Annex 1, Table 17.

January 1978

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Costs and Income Per Hectare (Before Water Charges)

Individual Sector With Project

Crops	Yield kg/ha	Price Per kg/ Din	Gross Income Din/ha	Seeds Din	Fertilizers, Pesticides, Mechanization Din/ha 5/	Hired Labor Din/ha	Product. Cost Din/ha	Net Income Din/ha	Cultivated Hectares	Total Net Income (Din'000)
Wheat Grain	4,000	3.0	12,000	1,000	4,827	0	5,827	6,173	2,150	13,271
Straw	3,000	-	1/	-	-	-	-	-	-	-
Maize Grain	5,500	2.5	1/	900	5,214	2,100	8,214	-	750	-
Sugar beet	50,000	0.58	29,000	1,800	8,694	4,500	14,994	14,006	1,400	19,608
Sugar beet tops	5,000	-	-	-	-	-	-	-	-	-
Sunflower	2,800	5.5	15,400	160	6,005	1,350	7,515	7,885	700	5,519
Soyabeans	2,200	5.5	12,100	360	4,092	900	5,352	6,748	300	2,024
Soyabeans straw	2,600	-	-	-	-	-	-	-	-	-
Tobacco	2,200	40.0	88,000	0 1/	4,887	2,250	13,137	74,863	1,100	82,349
Tomatoe (Industrial)	45,000	1.2	54,000	1,200	6,960	4,500	12,660	41,340	280	11,575
Tomatoe (Fresh)	30,000	3.5	105,000	800	6,960	6,000	13,760	91,240	300	27,372
Pepper (Industrial)	25,000	3.0	75,000	1,250	6,795	4,500	12,545	62,455	300	18,736
Pepper (Fresh)	20,000	5.0	100,000	900	6,795	7,500	15,195	84,805	270	22,897
Beans	2,000	10.0	20,000	600	4,045	1,350	5,995	14,005	300	4,201
Peas	3,000	7.0	21,000	420	4,045	1,350	5,815	15,185	200	3,037
Potatoes	20,000	4.0	80,000	10,000	8,427	3,000	21,427	58,573	500	29,286
Late Vegetables	25,000	3.0	75,000	3,000	6,151	6,000	15,151	59,849	800	47,879
Onions	12,000	6.0	72,000	9,000	5,381	3,000	17,381	54,619	300	16,385
Winter Vegetables	10,000	6.0	60,000	3,000	6,151	3,000	12,151	47,849	200	9,569
Alfalfa (Consumed)	12,000	1.8	-	400 3/	4,871	0	5,271	-	1,200	-
Maize Silage	35,000	-	-	200	4,772	0	4,972	-	500	-
Fodder Peas	25,000	-	-	900	4,507	0	5,407	-	1,150	-
Orchards	20,000	5.0	100,000	0 4/	7,238	4,500	11,738	88,262	400	35,304
Vineyards	18,000	5.0	90,000	0 4/	5,616	3,000	8,616	31,384	270	21,973
Grapes	16,000	6.0	96,000	0 4/	5,616	3,000	8,616	87,384	190	16,602
									13,560	387,587

1/ The following quantities of by-products and fodder crops are included in livestock models in the Project File.

Wheat straw	2,150 ha x 3.0 tons = 6,450 tons	Soyabean straw	300 ha x 2.6 tons = 780 tons
Maize grain	750 ha x 5.5 tons = 4,125 tons	Alfalfa hay	1,200 ha x 12.0 tons =14,400 tons
Sugar beet tops	1,400 ha x 5 tons = 7,000 tons	Maize silage	500 ha x 35.0 tons =17,500 tons
		Fodder peas	1,150 ha x 25.0 tons =28,750 tons

2/ Tobacco seeds provided by tobacco factory free of charge.
3/ Alfalfa seeds 40 kg x 40D = 1,600 D spread over 6 years @400 D/year.
4/ Investments for orchards (80,500 D/Ha) and vineyards (84,500 D/Ha) are taken into account in the economic analysis in ANNEX 1, Table 17.
5/ Expenses for fertilizers, pesticides, herbicides, mechanization for the private sector are estimated to equal 75% of the corresponding level in the Social Sector.

January 1978

YUGOSLAVIA
MACEDONIA STREZEVO IRRIGATION PROJECT
Private Sector – Growing Periods and Working Days per Cultivated Hectare (Family Labor + Hired Labor)

Working Days Per Ha: Family Labor	Hired Labor		March	April	May	June	July	August	September	October	November	December	January	February
30	0	WHEAT		2	1	1 8 4				3	1			
17	+ 14	MAIZE		3 2	1 (3 + 7) 1	1 (5 + 2) 3	1 1	1 1	(5 + 5)					
80	+ 30	SUGAR – BEET		2 + 2	1 (15 + 15)	1 (10 + 5) 3	1 1	1 1	1 1	(20 + 10)				
22	+ 9	SUNFLOWER		3	(5 + 5)	1 3	1 1	1 1	(4 + 3)					
35	+ 5	SOYABEANS		3	3	1 10 1	3 1	1	(12 + 8)					
76	+ 55	TOBACCO		Nursery 15 (10 + 20)	2 1	(10 + 10) 1	1 1		(25 + 35)	10				
72	+ 30	TOMATOES (INDUSTRIAL)		6	(10 + 5)	1 (15 + 15) 1	1 15 1	1 1	(20 + 10)					
85	+ 40	TOMATOES (FRESH)		Nursery 15	(10 + 20)	1 (20 + 10) 1	1 12 1	1 5 1	(20 + 10)					
103	+ 30	PEPPER (INDUSTRIAL)		6	(10 + 5)	1 (30 + 15) 1	1 15 1	1 5 1	1 (30 + 10)					
116	+ 50	PEPPER (FRESH)		Nursery 15	(10 + 20)	1 (30 + 15) 1	1 (20 + 5) 1	Green 1 5 1	Red (30 + 10)					
40	+ 9	PEAS AND BEANS		3	3 12	1 7 1	3 (10 + 0)							
50	+ 20	POTATOES		5 (10 + 2)	(15 + 5)	1 5 3	1 1 (15 + 10)							
60	+ 40	LATE VEGETABLES					Nursery 10	(10 + 20) 1	1 (15 + 10) 1	1 5 1	(15 + 10)			
52	+ 20	WINTER ONIONS	10	(10 + 10)					5	(10 + 5) 2	(15 + 15)			
60	+ 20	WINTER VEGETABLES	10	(10 + 10)					5	(10 + 5)	(15 + 5)			
30	+ 0	ALFALFA		1 5	2	1 5 1	1 1 5	1	1 1	5				
24	+ 0	MAIZE SILAGE					3	1 10 2	1 1	5				
31	+ 0	FODDER PEAS	5	Silage 5	or Hay 5				3	1 10 1	5			
70	+ 30	ORCHARD (PEAR, APPLE)	5	(10 + 10)		1 1	1 1	1 1	1 1	1 (10 + 10) 3	3	2	(20 + 10)	
66	+ 20	VINEYARDS – GRAPES	5	3	(10 + 5)	1 2 1	1 2 1	1 1	1 (20 + 10)	5	2	(10 + 5)		

World Bank – 18227

ANNEX 1
Table 12

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Agricultural Investment Plan

Invested Item	Total Cost	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Million Dinars									
PRIMARY PRODUCTION										
Social Sector										
Agricultural Machinery	105	-	-	-	-	74	31	-	-	-
Vineyards and Orchards	26	-	-	-	-	10	10	6	-	-
Livestock and Dairy	215	-	-	-	127	42	46	-	-	-
TOTAL INVESTMENT	346	-	-	-	127	126	87	6	-	-
PRICE CONTINGENCIES	169	-	-	-	50	59	55	5	-	-
TOTAL WITH CONTINGENCIES	515	-	-	-	177	185	142	11	-	-
Private Sector										
Agricultural Machinery	50	-	-	-	-	15	10	13	7	5
Vineyards and Orchards	75	-	-	-	-	11	15	23	26	-
Livestock, Barn and Equipment	84	-	-	-	-	84	-	-	-	-
TOTAL INVESTMENT	209	-	-	-	-	110	25	36	33	5
PRICE CONTINGENCIES	125	-	-	-	-	51	15	24	31	4
TOTAL WITH CONTINGENCIES	334	-	-	-	-	161	40	60	64	9
COLLECTION, STORAGE, TRANSPORT FACILITIES										
Social Sector										
Fruit and Vegetable Collection Centers	2	-	-	-	-	2	-	-	-	-
Warehouses	42	-	-	-	-	42	-	-	-	-
Cooperative Costs	3	-	-	-	-	3	-	-	-	-
Vehicles	1	-	-	-	1	-	-	-	-	-
Vegetable Selection, Packing Cold Storage	33	-	-	16	17	-	-	-	-	-
Milk Tank Truck	2	-	-	-	2	-	-	-	-	-
TOTAL INVESTMENT	83	-	-	16	20	47	-	-	-	-
PRICE CONTINGENCIES	38	-	-	4	8	26	-	-	-	-
TOTAL WITH CONTINGENCIES	121	-	-	20	28	73	-	-	-	-
COMMUNE OF BITOLA										
Building for Development Center	1	-	-	1	-	-	-	-	-	-
Vehicles for Development Center	1	-	-	1	-	-	-	-	-	-
TOTAL INVESTMENT	2	-	-	2	-	-	-	-	-	-
PRICE CONTINGENCIES	1	-	-	1	-	-	-	-	-	-
TOTAL WITH CONTINGENCIES	3	-	-	3	-	-	-	-	-	-
PROCESSING FACILITIES 1/										
Sugar Beet Processing Factory	370	-	123	123	124	-	-	-	-	-
Yeast and Alcohol Factory	40	-	-	20	20	-	-	-	-	-
Vegetable Processing	40	-	-	20	20	-	-	-	-	-
TOTAL INVESTMENT	449	-	123	163	163	-	-	-	-	-
PRICE CONTINGENCIES	160	-	27	55	78	-	-	-	-	-
TOTAL WITH CONTINGENCIES	609	-	150	218	241	-	-	-	-	-
GRAND TOTAL AGR. INVESTMENT	1,089	-	123	181	310	283	112	42	33	5
PRICE CONTINGENCIES	493	-	27	60	136	136	70	29	31	4
GRAND TOTAL WITH CONTINGENCIES	1,582	-	150	241	446	419	182	71	64	9

1/ Not comprehensive. Additional investments are expected as investment plans in other processing facilities are finalized.

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Individual Sector Farm Model: Present and Future Cropping Pattern

(Hectares)

Crop	0.8 ha Farms			1.75 ha Farms			3.5 ha Farms			6.0 ha Farms with dairy operations		6.0 ha Farms without dairy operations	
	Present and /1 Future w/o project	Future w/ project Farm A	Future w/ project Farm B	Present and /1 Future w/o project	Future w/ project Farm C	Future w/ project Farm D	Present and /1 Future w/o project	Future w/ project Farm E	Future w/ project Farm F	Present and /1 Future w/o project	Future w/ project Farm G	Present and /1 Future w/o project	Future w/ project Farm H
Wheat	0.30	0.07	0.245	0.80	0.40	0.30	0.85	1.00	0.50	0.75	1.00	1.00	1.33
Barley	-	-	-	0.13	-	-	0.20	-	-	0.65	-	0.40	-
Maize	-	-	-	-	-	-	0.35	0.60	0.27	0.52	1.50	0.85	0.33
Sugar beet	0.07	-	-	-	-	0.34	-	0.50	0.90	-	1.25	-	1.16
Sunflower	0.20	0.20	-	0.20	0.40	-	0.53	-	-	-	-	-	-
Soyabeans	-	-	-	-	-	-	-	0.25	0.25	-	0.50	-	-
Tobacco	0.06	0.30	-	0.07	0.40	0.13	-	-	0.40	-	-	-	-
Tomatoes (Industrial)	-	-	-	0.15	-	-	-	-	0.30	0.20	0.34	0.35	0.30
Tomatoes (Fresh)	0.05	-	0.125	-	-	0.25	-	-	-	-	-	-	-
Pepper (Industrial)	0.03	-	-	-	-	-	-	0.40	-	-	-	-	0.47
Pepper (Fresh)	0.01	-	0.125	-	-	0.20	-	-	-	-	-	-	-
Beans	0.04	0.20	-	-	-	-	-	-	-	-	-	-	-
Peas	-	-	-	-	-	0.30	-	-	-	0.20	-	0.20	-
Potatoes	0.04	-	0.20	-	0.30	-	-	-	-	-	-	-	-
Late Vegetables	-	0.193	-	-	0.30	0.30	-	-	-	-	-	-	-
Onions	-	-	-	-	-	-	-	0.20	-	-	-	-	0.73
Winter Vegetables	-	-	-	-	-	-	-	0.25	-	-	0.5	-	-
Alfalfa	-	-	0.06	-	0.15	0.15	0.17	0.75	0.25	0.65	1.0	0.15	0.93
Maize silage	-	-	-	-	-	-	-	0.75	-	-	1.0	-	-
Fodder Peas	-	-	0.125	-	0.19	0.19	-	0.50	0.25	-	2.0	-	-
Orchards	-	-	-	-	-	-	0.21	-	0.30	-	-	0.5	0.93
Vineyards	-	0.03	0.03	0.05	0.04	0.04	0.10	0.05	0.07	0.33	0.16	0.5	0.16
Grapes	-	-	-	-	-	-	-	-	0.30	-	-	-	0.23
Meadows & Pastures	-	-	-	0.25	-	-	0.59	-	-	1.50	-	0.85	-
Total	0.80	0.993	0.910	1.65	2.18	2.20	3.00	5.25	3.79	4.85	9.25	4.80	6.57
Cropping Intensity/2	100%	124%	113%	94%	124%	125%	86%	150%	108%	94%	154%	77%	109%

/1 Cropping pattern in future is expected to be the same with the present cropping pattern.
/2 Meadows and pastures are excluded in calculating cropping intensity.

January 1978

ANNEX 1
Table 14

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Individual Sector Farm Budgets
(Dinars)

	0.8 ha Farms				1.75 ha Farms				3.5 ha Farms				6.0 ha farm with dairy operations /1			6.0 ha farm without dairy operations		
	Present	Future w/o project	Future w/ project Farm A	Future w/ project Farm B	Present	Future w/o project	Future w/ project Farm C	Future w/ project Farm D	Present	Future w/o project	Future w/ project Farm E	Future w/ project Farm F	Present	Future w/o project	Future w/ project Farm G	Present	Future w/o project	Future w/ project Farm H
Gross value of crop production /2	14,470	17,290	51,500	47,270	16,040	19,160	96,260	103,510	16,020	19,530	93,430	151,630	20,440	24,920	117,060	34,730	42,340	280,090
Production costs excluding labor /2	3,850	4,600	5,970	7,540	5,150	6,150	15,250	13,740	5,620	6,850	20,830	22,120	8,020	9,780	29,410	10,080	12,290	45,520
Income from crop production	10,620	12,690	45,530	39,730	10,890	13,010	81,010	89,770	10,400	12,680	72,600	129,510	12,420	15,140	87,650	24,650	30,050	234,570
Income from livestock /3	-	-	-	-	800	800	960	960	8,280	8,280	24,510	8,940	40,040	40,040	173,220	14,360	14,360	14,360
Hired labor /4	-	-	-	-	-	-	-	-	-	-	(4,200)	(5,400)	-	-	(30,750)	-	-	(27,750)
Total Income	10,620	12,690	45,530	39,730	11,690	13,810	81,970	90,730	18,680	20,960	92,910	133,050	52,460	55,180	230,120	39,010	44,410	221,180
Taxes /5	(280)	(330)	(1,180)	(1,030)	(300)	(360)	(2,130)	(2,360)	(490)	(540)	(2,420)	(3,460)	(1,360)	(1,430)	(5,980)	(1,010)	(1,150)	(5,750)
Farm income before water charges	10,340	12 360	44,350	38,700	11,390	13,450	79,840	88,370	18,190	20,420	90,490	129,590	51,100	53,750	224,140	38.000	43,260	215,430
Water charges (Din 6,680/ha)	-	-	(5,340)	(5,340)	-	-	(11,690)	(11,690)	-	-	(23,380)	(23,380)	-	-	(40,080)	-	-	(40,080)
Farm income from agriculture	10,340	12,360	39,010	32,700	11,390	13,450	68,150	76,680	18,190	20,420	67,110	106,210	51,100	53,750	184,060	38,000	43,260	175,350
Total labor requirement (man-day)	20	25	80	70	25	30	140	180	75	90	245	250	175	210	580	125	145	500

/1 6.0 ha farm with livestock operations (200 farms). This model corresponds to Farm G. The remaining 6.0 ha farms without livestock operations correspond to Farm H (300 farms)
/2 2% p.a. increase in yields and in production costs is assumed in future without project. The increase at this rate is assumed to continue until 1987.
/3 No increase in livestock productivity is expected without project.
/4 Din 150/man-day.
/5 2.6% of value added.
/6 Din 2/m^3. Water requirement is estimated to be 3,340 m^3/ha.

January 1978

ANNEX 1
Table 15

ANNEX 1

Table 16

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA
Cost Recovery

Present value discounted at 10% p.a.

	Irrigation	Town Water Supply	Thermal Power	Total
	Din million			
Total Water Charges	771	624	737	2132
Cost Recovery Index	0.37	4.11	8.10	0.91

June 1978

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Economic Rate of Return
(Dinars Millions)

Calendar Year	Project Year	Incremental Economic Costs: Construction	Incremental Economic Costs: Operation & Maintenance	Incremental Economic Costs: Agricultural Services	Incremental Economic Benefits: Temporary Crops	Incremental Economic Benefits: Orchards & Vineyards	Incremental Economic Benefits: Livestock	Incremental Economic Benefits: Flood Control	Incremental Economic Benefits: Sale of Bulk Water to Vodovod /1	Incremental Economic Benefits: Sale of Bulk Water to Electrostopanstvo /2	Incremental Economic Benefits: Salvage Values	Net Economic (Cost) Benefit
1978	1	508	2	-	-	-	-	-	-	-		(510)
1979	2	728	2	-	-	-	-	-	-	-		(730)
1980	3	695	2	-	-	-	-	-	-	72		(625)
1981	4	462	29	2	-	-	-	-	-	72		(421)
1982	5		35	3	79	(24)	(310)	6	61	72		(154)
1983	6		35	3	156	(34)	33	6	64	72		259
1984	7		35	3	230	(35)	57	6	67	72		357
1985	8		35	3	299	(24)	64	6	71	72		450
1986	9		35	3	326	19	74	6	74	72		533
1987	10		35	3	334	45	76	6	77	72		572
1988	11		35	3	334	63	78	6	80	72		595
1989	12		35	3	334	76	82	6	83	72		615
1990	13		35	3	334	82	82	6	87	72		625
1991	14		35	3	334	83	82	6	90	72		629
1992	15	60	35	3	334	83	82	6	94	72		573
1993	16		35	3	334	83	82	6	97	72		636
1994	17		35	3	334	83	82	6	100	72		639
1995	18	81	35	3	334	83	82	6	103	72		561
1996	19		35	3	334	83	82	6	106	72		645
1997	20		35	3	334	83	82	6	109	72		648
1998	21		35	3	334	83	82	6	113	72		652
1999	22		35	3	334	83	82	6	116	72		655
2000	23		35	3	334	83	82	6	120	72		659
2001	24		35	3	334	83	82	6	125	72		664
2002	25	60	35	3	334	83	82	6	125	72		604
2003	26		35	3	334	83	82	6	125	72		664
2004	27		35	3	334	83	82	6	125	72		664
2005	28		35	3	334	83	82	6	125	72		664
2006	29		35	3	334	83	82	6	125	72		664
2007	30		35	3	334	83	82	6	125	72	3,441	4,105

/1 Vodovod supplies water to the town of Bitola.
/2 Electrostopanstvo uses cooling system make up water for the generation of electricity.

Economic Rate of Return = 15%

January 1978

ANNEX 1
Table 17

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Project Works

Strezevo Dam and Appurtenant Structures

1. The dam has been proposed in a high valley in the middle stretch of the Semnica River, 15 Km to the north-east of the town of Bitola. The dam with a total storage volume of 112 Mm3 would be a fill structure with a maximum structural height of 84 meters. The total volume of the fill would be 3.5 Mm3 and would be obtained from the alluvial plain in the vicinity of the dam. Water tightness would be ensured by a central clay core and a grouting curtain from a grouting gallery along the bottom of the clay core. The prevailing outer slopes of the fill would be 1:2 with a 10 meter wide dam crest. A shaft and tunnel spillway would be provided on the left flank. A diversion tunnel, to be transformed later into a bottom outlet, would be provided on the right bank. An irrigation intake with a corresponding intake tunnel would also be placed on the right bank. Upstream and downstream cofferdams have been foreseen and would eventually be incorporated into the main body of the dam.

2. Site Investigations, Geology and Stability of Dam. Ample investigation works were performed for the Strezevo dam. Investigation bore-holes amounted to 1,500 m, trial grouting to 650 m, investigation galleries to 400 m and pits to 70 m. In-site shear tests were performed on four blocks. Considerable testing of construction materials and geophysical prospecting was done.

3. Geologically, the dam site is located in paleozoic metamorphic rock. The structural anticline has left the right flank tectonically undisturbed but the left flank formed by sericite and muscovite schists are much more disturbed. A prominant fault line intersects the left dam abutment and passes to the right bank of the valley upstream of the dam. These schists are mechanically the weakest, and give rise to weathered layers near the surface which have been transformed into clayey materials of weak shearing strength. With the exception of these schists, the foundation rocks are generally satisfactory for the proposed type of dam. Four sliding blocks were tested in the medium of the schists. The minimum value obtained for the angle of friction was 25 degrees but even lower values could be expected in the weathered strata underlying the alluvium cover, which may pose stability problems. A sensitivity check on a dam section 80 m high and postulating consecutively the friction angle at foundation interface with values of 20°, 25° and 30° with rapid drawdown of the reservoir, revealed

safety factors from 1.2 to 1.9, against design criteria of 1.5. To correct the conditions of stability the alluvium and decomposed rock layers would be excavated as far as possible and in addition to down stream berm 30m x 60m would be introduced.

4. Spillway. The spillway structure would be in the form of a shaft, linked by a free flow tunnel and a chute to the spillway stilling basin. The spillway capacity would cater for a design flood with a return period of 10,000 years. The storage retention effect would reduce the inflow design peak flood hydrogram of 400 m3/sec to an outflow of approximately 200 m3/sec.

5. Grouting and Drainage. A grouting curtain in two rows spaced 3 meters apart, would be provided in the tectonically disturbed quartzites extending to a depth of 60 m, to 80 m, from a grouting gallery placed below the clay core. A drainage blanket would be provided beneath the central part of the dam. Due to poor geomechanical characteristics of the serriate schists on the left flank, the drainage blanket would be provided in depth to provide efficient pore pressure dissipation in foundation layers.

6. Coffer Dams and Diversion Tunnel. The system has been designed to provide for diversion of a flood with a ten year return period, amounting to 150 m3/sec, diverted through a 4.6 m diameter tunnel placed on the right bank. To meet the completion target of four years, the diversion tunnel would be started by the Yugoslav authorities during 1978 prior to the approval of the proposed loan.

7. Irrigation Intake. This structure would be placed on the right bank consisting of an inlet tunnel of 2.5 m diameter, gate shafts, down stream regulation gate, and energy dissipation basin.

8. Bottom Outlet. The diversion tunnel placed on the right bank would be converted into a bottom outlet. The upstream portion of the diversion tunnel would be closed by a concrete plug. The maximum capacity of the bottom outlet would be 30 m3/sec enabling emptying of the reservoir, if necessary, and providing the biological minimum.

Alimentation Canal (Collector Canal)

9. The catchment of the Semnica river, on which Strezevo dam will be located, is insufficient to meet the requirements of irrigation. Supplies from seven streams emanating from the Baba Mountains would therefore be diverted into the Strezevo reservoir by a canal 62 km in length. Diversions would take place only during months of surplus flow (October to May) so that existing uses on these streams during the dry summer months are not disturbed.

10. The alimentation canal would start from the intake on the Kisevska River at a level of 1,059 m asl and would terminate at its point of inflow into the Rotinska River at a level of 907 m asl. The Rotinska eventually flows into the Strezevo reservoir. A series of 47 falls each 1.5 m high would be provided in it to reduce the velocity created by the prevailing steep slopes.

11. All seven intakes would be provided with Tyrol type gates with siltation reservoirs. The slope of the channel would vary from 1.7 to 3.0 0/00 and would have the following capacities:

Names of Stream	Mean Annual Flow x1-8	Canal Capacity
	m3/sec	
Kisevska	0.58	0.58
Graeska	0.37	0.95
Veluska	0.53	1.48
Bistricka	0.71	2.19
Stara Reka	0.33	2.52
Kinderka	0.16	2.68
Dragor (Sapuncjca)	2.36	5.04

The channel would be covered along its entire length. Reinforced concrete channel would be used in geologically weak stretches, but primarily construction would be with mass concrete. About 130 structures would be constructed which would consist of road crossings, torrent crossings, syphons, aquaducts and spillways. The alimentation canal has been designed to convey 1.8 times the mean annual flow of the streams, accumulative in sequence. Losses within the channel have been assumed to be 5% so that 49 Mm3 would become available in addition to the 63 Mm3 from the Semnica River.

Main Canal

12. The intake structure of the main canal would consist of a tunnel 310 meters long and would convey the stored waters of the Strezevo Dam. The main canal would commence immediately at the end of the tunnel, located at an elevation of 692.86 meters asl.

13. As a basis for planning the layout of the main canal, geodetic survey sheets to a scale of 1:2500 were used and the proposed alignment transferred to the field through installation of permanent markers. The canal alignment has further been connected to the triangulation grid.

14. The geological and geo-mechanical investigations were carried out. Field samples and construction materials were tested. Shallow pits, 176 in number, ranging in depths from 1 to 4.5 meters were excavated along the center line of the canal, spaced at an average distance of 250 meters. In addition adits were excavated in a total length of 300 meters, primarily near the entrance and exit of tunnels. The terrain along the alignment of the canal was found to consist of schists and intrusions of large granite masses. Based on the test results of these pits, adits and some trenches, supplemented by surface geological observations, the specific engineering geological characteristics of the terrain have been established on maps. Special safety measures would be provided at 8 locations, where likelihood of landslides has been anticipated. Two of these locations at Station Km 2 + 200 and 40 + 030 have been considered most unstable and further investigations on soil stability would be carried out during excavation. The location of the main canal

is such that it would provide pressurized irrigation of the area without recourse to pumping.

15. The Canal has been designed with a capacity of 12.31 m3/sec at head of which 11.11 m3/sec would be used for irrigation, 0.70 m3/sec for augmenting domestic water supply for the town of Bitola and the remaining 0.50 m3/sec for supplying cooling water to the Thermal Power Plant. The peak monthly irrigation requirements would be 1,100 m3 per hectare based on the demand for August. Losses in the system have been assumed at 25%, bringing the gross monthly diversion requirements during August to 1,466 m3 per ha. The design of the canal has therefore been based on the following hydromodule.

$$q \text{ hydromodule} = \frac{1466}{3.6 \times 24 \times 31} = 0.55 \text{ l/sec/ha}$$

$$Q \text{ irrigation} = \frac{0.55 \times 20{,}300}{1000} = 11.11 \text{ m3/sec}$$

The canal design has been optimized on the basis of economic comparison on a number of alignments and its of 0.8% adopted. Due to very bad configuration of the terrain, the canal would be covered by an arch structure in the first 30-kilometers and the remaining 25 kms would remain open with a trapezoidal section. The canal would be provided with about 337 structures, consisting of tunnels, syphons, aquaducts, spillways, road crossings, torrent transitions and upstream control gates with intakes. Designs for typical structures of each type have been prepared, and quantity surveys have been used for arriving at their cost.

16. For purpose of regulation the canal would be provided with a minimum of 9 upstream control automatic gates, Amil type or similar, to ensure a constant water level in the canal upstream of each gate. These gates would limit losses during closures and also make it possible to keep the canal from going dry in front of the intakes for irrigation. All intake structures would include silting basins to minimize entry of fine silt in the pipes and resultant damage to sprinkler nozzles. Adequate free board would be provided in the entire length of the main canal.

17. Irrigation Network. The network will serve both the social sector, a modern large agricultural enterprise covering 9,500 ha, and the individual sector, consisting of 10,800 ha of small fragmented holdings. Irrgation is supplemental. The capacity of the network has been sized to meet the demands during July and August when there is practically no rainfall. Of the total annual consumption, 77% occurs during July and August, and a twenty-four hour operation would be required to apply the required volume of water during these months. From the main canal, 9 primary pipes would take off at about 2,000 m intervals (IBRD Map 13405). Steel pipes would be used for sizes larger than 500 mm, while smaller sizes would be asbestos cement. From the primary pipes 864 m long secondary pipes would take off at 632 m intervals in a fishbone pattern on both sides of the primary pipes. Both in the social and private sectors, five double outlet hydrants would serve a block of 192 m x 312

m x 2 or 12 ha. Since pressures at the downstream end of the primary pipes fluctuate between 19 atmospheres, at minimal discharge (static pressure), and 5 atmospheres, at full discharge (high friction losses), hydrants on one secondary would operate in rotation. Foreign consultants would be engaged to review the design of the irrigation network prior to preparation of the tender documents.

18. Mobile Sprinkler Equipment (Individual Sector). The individual sector would be provided with 300 m flying lines composed of numeorus sections of quick coupling pipes in a 24 m x 24 m sprinkler pattern. Each line would have 13 sprinklers, and during peak demand, would operate in one position for 11 hours. On the same 12 ha block a second sprinkler line would be waiting to be switched on for the next 11 hour period. A 12 ha block would thus have a total of 16 positions for the flying lines and a return period of 8 days. Each sprinkler would have a discharge of 0.88 litres/sec, nozzel pressure of 4.5 atm, and an intensity of 5.5 mm/hr. This design criteria would meet the peak demand for sugar beets during August. In spite of extreme parcellization, there is a pronounced tendency among farmers in the project area to group their parcels together in larger blocks on which different farmers grow the same crop. The design of the system has therefore been conceived in such a way that an eventual development of 12 ha blocks under the same crop would take place while farmers would retain their legal ownership of the individual parcels.

19. Mobile Sprinkler Equipment (Social Sector). The area in the social sector would be irrigated by "booms", consisting of a 4 wheel self-propelled under carriage supporting a 74 m diameter rotating boom on which sprinklers are mounted. The booms would operate on a 100 m x 100 m sprinkler pattern (1 ha). The machine would operate at an intake pressure of 5 atm and would give an intensity of 9.1 mm/hr. To meet the peak requirements during August 6.7 hours' operation in one position would be necessary, with three different positions in 24 hours and a return period of 8 days. Infiltration tests have shown that the intensity of water application from the sprinklers can be absorbed by the soil without runoff. The above system of operation would require one boom for every 24 ha. However, due to crops with lesser demand in the cropping pattern, the average area served by one boom would be 30 ha (10 day return period). The choice of booms for the social sector is based on a comparative economic study of various types of equipment, accounting for their respective labor requirements and the pressure head available for their operation.

20. Drainage. An extensive drainage network was constructed during the reclamation of the Pelagonia swamp. Under the project, additional surface drains would be provided with a specific discharge of 1.25 l/sec/ha based on the one in 20-year 24-hour rainfall. Secondary drains would be located on each side of a farm road, running parallel to the secondary underground pipes and would discharge into primary drains, running halfway between and parallel to the primary pipes.

21. Buildings. The project would require office buildings for exploitation of the system. The 20,200 ha would be divided into three sections of about 7,000 ha each, with three primary pipe lines. Each section would require 108 m2 of office space based on an average of 9 office workers per section with 12 m2 per person. In addition, a 250 m2 store for equipment and 90 m2 of auxiliary buildings would be provided per section. For the Central Project Management, 52 persons would need office space, for which 624 m2 of new offices would be provided adjacent to the existing main offices.

22. Roads. There is a fairly extensive road network in the project area. The project would provide 63 km of 5 m wide asphalt roads running along the primary pipes. Farm dirt roads, 4 m wide, would be constructed perpendicular to the asphalt roads and parallel to the secondary pipes.

Bulk Water Supply for Town of Bitola

23. In the mountains west of the town of Bitola, a weir was constructed in the early fifties, on the Sapuncica tributary to the Dragor River, with water also diverted to this location from another smaller tributary. Some 4.5 km of concrete channel and 1.0 km of steel pressure pipe convey water from the Sapuncica weir to a small hydroelectric power plant. Downstream of the power plant the water flows to the Dovledzik water treatment plant, with a present capacity of 240 l/sec and then by gravity to the town's distribution system. There is no storage in the Sapuncica system and summer flows are as low as 80l/sec, considerably less than the town's requirements. A related problem is that maintenance of the Sapuncica conduit is virtually impossible as it is in constant use to supply Bitola. Total present use of water for industrial and domestic purposes does not exceed 8.5 Mm3 of which about 6.5 Mm3 are derived from the Sapuncica while the remainder is made up from some highly mineralized ground water wells.

24. The future industrial and domestic uses in the year 2000 for the town of Bitola and its vicinity have been estimated at about 28 Mm3 of which 22 Mm3 would be supplied by the Strezevo Irrigation project. The project would provide up to 17 Mm3 bulk water to the enterprise "Vodovod i Banji" from the alimentation canal where it crosses the Dragor River while the remaining 5 Mm3 would come from the main canal, during the summer months. The construction of intakes, pumping station on the conduit from the main canal, and all other water conveyance structures would be separately financed by the Vodovod, outside of the project.

Bulk Water Supply for Thermal Power Plant

25. A thermal power plant with a capacity of 420 MW is now under construction at Novaci, near recently discovered lignite reserves at Suvodol, 19 kms east of Bitola. Make-up water for cooling required for this phase would be 12 Mm3 annually and would be provided by the Strezevo project. The main water supply of the thermopower plant would be the runoff from the Dragor river catchment downstream of its crossing the alimentation canal. The water would be diverted through a Tyrol type intake with stilling pool, and passed

into a collecting basin at elevation 655 m asl, from where a steel pipe would carry it to the edge of the irrigated area to the banks of the Crna River. Shortages, to the extent of 2 Mm3 are expected to occur in some summers for which diversion provisions would be made from the alimentation canal as well as the main canal.

26. The water would be supplied in bulk at the Crna River and the Enterprise "Electrostopanstvo" would be responsible for the financing and construction of conveyance, storage and treatments at the Novaci plant and at Suvodol where a small reservoir is under construction for equalizing seasonal flow and protecting the mine from flooding. The Thermal Power Plant is due for completion in its first phase by the end of 1979. The diversion structure and the pipeline from the Strezevo project for this purpose would, therefore, be constructed prior to December 31, 1979. The Novaci Thermal Station would be expanded in 1982, but none of the water requirements for the second phase would be provided from the Strezevo project.

Irrigation Feasibility Studies

27. Construction of irrigation projects in the Vardar Basin of the Socialist Republic of Macedonia began in the early 1950's. Development of irrigation has been proceeding slowly, at an average rate of about 4,000 ha annually. Review of Macedonia's long range irrigation requirements and preliminary feasibility work on a number of other projects has been carried out under an irrigation study included in the First Agro-Industries Project, but it is clear that extensive additional preparatory work would be necessary to bring the projects to levels acceptable to the Bank.

28. Preparation of three feasibility studies for the development of land and water resources of Skopsko Pole (15,700 ha), Pepelisko Pole, (4,000 ha), and Gevgelisko Pole (8,800 ha) would be carried out by the Government of Macedonia with Melioprojekt as project consultants, who would be supported by specialized engineering consultants whose qualifications, experience and terms and conditions of employment and scope of work would be satisfactory to the Bank. The technical, economic and financial feasibility studies would, inter alia, cover preliminary design of irrigation and drainage facilities, technical agricultural preparation and recommendations on institutions and organizations. The specialized consultants would be employed before December 31, 1978.

July 1978.

ANNEX 3

APPRAISAL OF

MACEDONIA STREZEVO IRRIGATION PROJECT

YUGOSLAVIA

Related Documents and Data Available in the Project Files

A. General reports and studies on the agriculture sector

A.1 World Bank "The Economy of the Socialist Republic of Macedonia Yugoslavia" (3 volumes), June 28, 1976.

B. General reports and studies relating to the project

B.1 Hydrosystem "Strezevo-Bucin", report by Water Management Organization, "Pelagonija" '7 volumes) - Bitola, March 1977.

B.2 Runoff from Baba Planina Hydrological expertise by "Jaroslav Cerni", Institute for Development of Water Resources, Belgrade 1977.

B.3 Reports on Strezevo Project by Compagnie Nationale d'Amenagement de la Region du Bas-Rhone Languedoc, Nimes, France, October-November 1976 and April 1977.

B.4 Report on Strezevo dam design by Mr. Alexander Bozovic, Chief Engineer Energoprojekt, Belgrade, May 1977.

B.5 Report on Domestic Water Supply for Bitola by Mr. B. Grover, Ottawa, March 1, 1977.

B.6 Resolutions, Proposals, Self-Management Agreements and Decrees by SR Macedonia, Bitola Commune and other parties involved in project construction, implementation and water use.

C. Selected Working Papers

C.1 Report by World Bank Preparation Mission, Washington, July 22, 1977.

C.2 Report on review of hydrology of Seminica River and Baba Mountain streams and Operation Study of Strezevo Reservoir.

C.3 Preparation reports on Strezevo Project (Design Calculations, drawings Estimates - six volumes), September 1977-January 1978.

C.4 Project Implementation File.

YUGOSLAVIA

MACEDONIA - STREZEVO IRRIGATION PROJECT

PROJECT LOCATION

This map has been prepared by the World Bank's staff exclusively for the convenience of the readers of the report to which it is attached. The denominations used and the boundaries shown on this map do not imply, on the part of the World Bank and its affiliates, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

FEBRUARY 1978

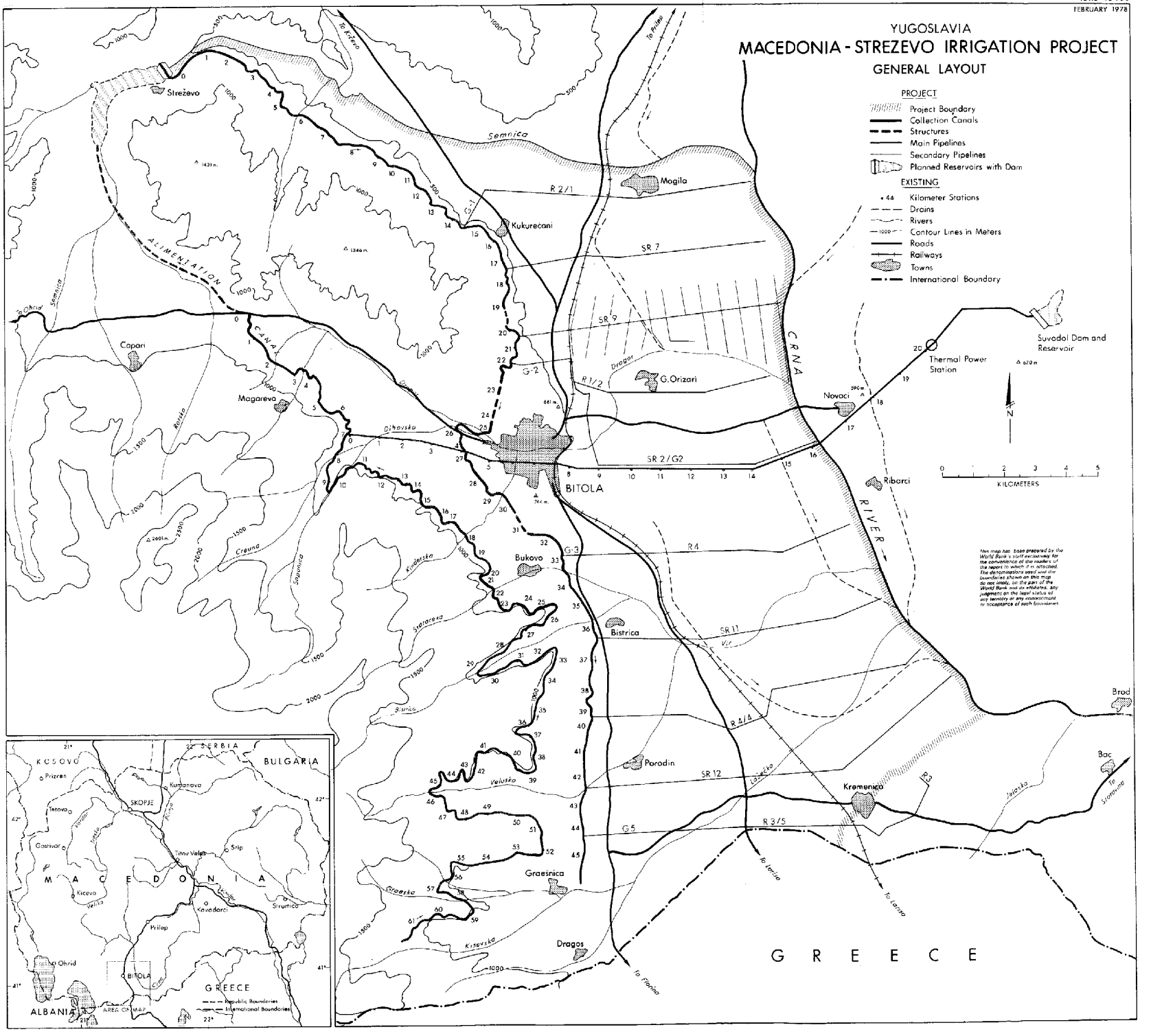
IBRD 13404

IBRD 13405
FEBRUARY 1978

YUGOSLAVIA

MACEDONIA - STREZEVO IRRIGATION PROJECT

GENERAL LAYOUT



This map has been prepared by the World Bank's staff exclusively for the convenience of the readers of the report to which it is attached. The denominations used and the boundaries shown on this map do not imply, on the part of the World Bank and its affiliates, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.