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Fiji
Appraisal of the Sugar Development Project

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East Asia and Pacific Projects Department
Irrigation and Area Development Division

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CURRENCY EQUIVALENTS

US$1.00	=	Fiji Dollar (F$) 0.85
F$1.00	=	US$1.17
US$1 million	=	F$854,000
F$1 million	=	US$1,171,500

WEIGHTS AND MEASURES - ENGLISH SYSTEM

1 inch (in)	=	25.40 milimeters
1 foot (ft)	=	0.305 meters
1 mile (mi)	=	1.609 kilometers
1 acre (ac)	=	0.405 hectares
1 mile^2 (mi^2)	=	2.590 kilometers^2
1 pound (lb)	=	0.454 kilograms
1 hundredweight (cwt)	=	50.80 kilograms
1 long ton (ton)	=	1,016 kilograms
1 mile/hour (mph)	=	0.447 meters/second
1 ft^3/minute (cfm)	=	0.472 liters/second
1 horsepower (hp)	=	745.7 watts
1 yard^3 (yd^3)	=	0.765 meters^3
1 gallon (gal)	=	4.546 liters

INITIALS AND ACRONYMS

CSR	-	Colonial Sugar Refining Company Limited of Australia
DID	-	Drainage and Irrigation Division of MAFF
DPVII	-	Development Plan VII (1976-1980)
FDB	-	Fiji Development Bank
FSC	-	Fiji Sugar Corporation Limited
MAFF	-	Ministry of Agriculture, Fisheries and Forests
PWD	-	Public Works Department
NLDC	-	Native Land Development Corporation Limited
NLTB	-	Native Land Trust Board
SPSM	-	South Pacific Sugar Mills Limited (Predecessor to FSC)

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SUMMARY AND CONCLUSION

1. The Government of Fiji has requested Bank assistance in financing a Sugar Development Project, which would increase sugarcane production by completing an ongoing settlement scheme at Seaqaqa (pronounced "Seang-gang-ga") on the island of Vanua Levu and by improving drainage on low-lying coastal sugarcane lands on Viti Levu and Vanua Levu. The settlement part of the project would consist of land clearing and the establishment of sugarcane on about 8,000 ac of rolling, scrub- and forest-covered land; construction of a sugar tramline extension, main road improvements and farm access roads; sites and services for a new township; and loans from the Fiji Development Bank for the purchase of tractors, farm implements, sugarcane transport vehicles and first year subsistence to the settlers. The drainage improvement part of the project would include reconstruction of seawalls with tidal gates; improvement of internal drains on 26,400 ac of sugarcane land; photogrammetric mapping; and procurement of vehicles and construction of offices.

ii. The Government gives high priority to agricultural growth and increased sugar production for export. A related objective is increased participation of native Fijians in commercial agriculture. To increase production the Government has adopted a dual approach to improving the efficiency of land use by encouraging farmers to bring unused land into production and by restoring the productivity of high potential coastal land where drainage has deteriorated. In support of the Government's new priorities, the Fiji Sugar Corporation began an investment program in 1973 to increase sugar output. Part of this program involves an increase in the annual capacity of the Lambasa mill on Vanua Levu by 25,000 tons. To meet this increase the Government and the Corporation began the settlement of about 800 farmers, half of Indian descent and half native Fijian, to produce 200,000 tons of sugarcane per year on largely uncultivated land at Seaqaqa, about 25 miles west of the mill. Investigations have also shown that a further 200,000 tons of sugarcane could be produced annually by reconstructing seawalls and improving internal drainage in coastal areas where saltwater intrusion and waterlogging have led to falling yields.

iii. Total project cost is estimated at F$22.2 million (US$26.0 million) of which US$12.0 million, or approximately 46%, would be in foreign exchange. The Bank would finance the foreign exchange component. A subsidiary loan agreement would provide for the on-lending of US$6.0 million from the Government to the Fiji Development Bank on the same terms as the Bank loan except that the Government would bear the foreign exchange risks. Since the Seaqaqa settlement is an ongoing project, it is proposed that expenditures incurred beginning January 1, 1976 would be eligible for Bank assistance, with the exception of earthworks for the tramline extension, for which retroactive financing to September 1975 is proposed. About US$550,000 of retroactive financing would be involved, including US$350,000 for the tramline.

iv. Earthworks for the tramline extension (US$0.8 million) are being carried out under contract awarded in September 1975 after international competitive bidding in accordance with Bank Group guidelines for procurement. The award was reviewed by Bank staff. To maintain the project's momentum and ensure that cane transport does not become a bottleneck to the realization of project benefits, it would be appropriate to include these works in the project as well as to provide retroactive financing. Fiji Sugar Corporation staff would construct bridges and install the rails using materials already on hand. Civil works for land clearing (US$1.7 million), seawall reconstruction and internal drainage improvements (US$4.5 million) would be carried out under contracts awarded after local competitive bidding. The small, scattered nature of these works makes them unsuitable for international competitive bidding. The same would apply to construction of the main, farm access and township roads (US$5.4 million), and since it is expected that the local contracting industry would be fully extended with other ongoing and anticipated work, these roads would be constructed by force account. Equipment for road construction and maintenance (US$1.8 million) would be procured in accordance with local procedures. International competitive bidding would not be warranted because of the small number and diversity of items involved, the desirability of standardization with existing equipment and the advantage of existing service arrangements with local suppliers. Tractors and farm implements (US$0.6 million) would be purchased after local shopping by borrowers with credit provided by the Fiji Development Bank. Three specially designed cane transport vehicles (US$0.2 million) would be purchased for the 1976 harvest. Procurement arrangements for ten more such vehicles (US$0.7 million) would be determined after review by the Government and the Bank of the perforamnce of the equipment.

v. Implementation would take five years. The two parts of the project would be carried out independently under the overall direction of the Permanent Secretary for Agriculture, Fisheries and Forests. For the Seaqaqa settlement, he would be chairman of a central coordinating committee responsible for policy in the settlement area. A Project Manager appointed by and reporting to the Permanent Secretary would be responsible for the settlement; the Public Works Department would be responsible for constructing and maintaining project roads, and the Drainage and Irrigation Division of the Department of Agriculture in conjunction with local Drainage Boards would be responsible for drainage improvement.

vi. At full development, annual incremental sugarcane production from the project is expected to be 330,000 tons. Resulting raw sugar exports of 41,000 tons would earn US$13.1 million a year in foreign exchange. The project would benefit some 3,400 sugarcane farmers and their families, or 17,000 people, plus about 500 new township residents. It would create 3,500 agricultural jobs during the six-month crushing season and 800 jobs during the slack season. Annual per capita incomes in the settlement area would increase from about US$200 at present, compared with a national per capita GDP in 1974 of US$640, to US$800 after repayment of project loans, or about

90% of anticipated per capita GDP in 1985 of US$875. Per capita incomes of US$520 to US$590 for farmers affected by poor drainage would increase to US$870 with the project.

vii. The cost of the Seaqaqa settlement comes to about US$15,500 per family of five, including the residents of the proposed new township. The high cost is due largely to the heavy investments required in road and rail infrastructure to move large amounts of a heavy, bulky commodity over unfavorable terrain in a short time. Excluding the cost of the tramline, the main road and the township, and considering only the settler/farmers as beneficiaries, the cost per family would be just over US$10,000. Further excluding the credit elements, which would be fully repaid over five years, the cost per family would be US$8,500. The settlement would bring settlers up to the income level of sugarcane farmers elsewhere in Fiji. The cost per family in the drainage improvement areas would be much lower -- US$3,200 for the entire investment or US$2,100 excluding seawall reconstruction, which the Government considers a national responsibility.

viii. The economic rate of return on all project investments combined and for each part of the project separately would be about 20%. Under a number of adverse assumptions, the rate of return on each part of the project would still exceed 13%.

ix. The proposed project is suitable for a Bank loan of US$12.0 million, with a 20-year maturity including a grace period of five years. The borrower would be Fiji.

FIJI

APPRAISAL OF THE SUGAR DEVELOPMENT PROJECT

I. INTRODUCTION

1.01 The Government of Fiji has requested Bank assistance in financing a Sugar Development Project. The project would increase sugarcane production by completing an ongoing settlement scheme at Seaqaqa (pronounced "Seang-gang-ga") on the island of Vanua Levu and by improving drainage on low-lying coastal sugarcane lands on Viti Levu and Vanua Levu.

1.02 The project was identified by a Bank mission in September/October 1974 and prepared by the Government of Fiji with assistance from the FAO/IBRD Cooperative Program. This report is based on the findings of an appraisal mission, which visited Fiji in July/August 1975, composed of Messrs. R.L.P. Harris (Bank), W.F.L. Bright and D.E.M. Fiennes (Consultants).

II. BACKGROUND

General

2.01 Located in the South Pacific about 3,200 km northeast of Sydney, Australia, Fiji is a small country isolated from the main centers of world population and trade. The 300 islands of the Fiji Group are scattered over 90,000 mi^2 of ocean, but their total land area is only about 3,000 mi^2. Of the 100 or so permanently inhabited islands, the two largest, Viti Levu and Vanua Levu, account for 90% of the total land area and more than 90% of the population. Total population is 564,000 (1974) of which 42% are Melanesians, locally called "Fijians," 50% are of Indian descent and 8% are Chinese, whole or part Europeans and other races. During the past decade Fiji has achieved a remarkable reduction in its population growth rate from 3.3% per year in the 1956-65 period to 1.8% in 1974, largely due to a successful family planning program. Real GDP per capita grew at 4.9% annually from 1965 to 1973 and reached US$640 in 1974 at current prices. 1/

The Agricultural Sector

2.02 The Fiji economy has traditionally relied upon agriculture with sugar and copra the main sources of cash income, supplemented by a large subsistence economy. Some 60% of the population is supported by farming in part or in whole. Despite Fiji's generally good overall growth performance during tne past decade, output in agriculture, fisheries and forestry has

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1/ Government of Fiji, Bureau of Statistics, Current Economic Statistics, April 1975.

remained stagnant. As a result, the sector's share of GDP fell from over 40% in the early 1960's to 25% in the early '70s. The imbalance between agriculture and the rest of the economy has led to increasing rural-urban population drift and growing imports of food items such as rice, dairy and beef products.

2.03 After sugar (para 2.04), coconuts are the second most important commercial and export crop in Fiji. They are grown mainly by Fijians in Vanua Levu, Taveuni and the outer islands of the Lau Group (Map 11851). There is a small but potentially important livestock and dairy industry on the wet, windward side of Viti Levu supplying the domestic market. Rice is also grown on the main islands, mostly by Indians as a subsistence crop. Fijian subsistence agriculture accounts for about 40% of agricultural output and is generally found in the interior of the islands and on coastal land not occupied by cane or coconuts. It consists mainly of root crops grown under an extensive system of land rotation. Inshore fishing is traditional among Fijians and forests are also an important resource.

The Sugar Industry

2.04 Sugar is Fiji's largest industry, contributing 10% of GNP and 70% of export earnings; it is the country's largest employer, with about 30,000 direct employees. Sugarcane occupies a contract area of about 165,000 ac, or 37% of Fiji's productive land, of which about 70% is harvested each year. Sugarcane is grown mainly in alluvial areas of western Viti Levu and northern Vanua Levu. It is estimated that, based on topography, soils and the level and distribution of rainfall, sugarcane yields over the whole cane area of Fiji, should average 24 ton/ac harvested compared with an actual average yield of about 20 ton/ac. Production reached a peak of 394,000 tons of raw sugar in 1968 but fell steadily from 355,000 tons in 1970 to 269,000 tons in 1974 due to bad weather in some years, increasing salt water intrusion along the coast, waterlogging in low-lying areas and poor field management. About 25,000 tons are sold domestically and the remainder is exported, mainly to the U.K.

2.05 Sugarcane farming developed in Fiji in the late nineteenth century and was initially characterized by plantation management and wage labor, including a large number of Indians on indenture contracts. With the end of indentured immigration in 1916 and the collapse of the sugar market in 1920, the plantation system became financially unviable and was transformed into the tenant and small farm system which persists today. Under this system, individual growers typically lease 10-12 ac farms and provide cane for the mill under contract. Today 85% of the sugarcane area is farmed by the descendants of the Indian laborers and 13.5% by Fijians, mainly on leases from the Native Land Trust Board (para 2.10). The remaining 1.5% of the cane area is farmed on an estate basis by FSC or by a small number of smallholders of other races.

2.06 By 1926 the Colonial Sugar Refining Co. Ltd. of Australia (CSR) was the sole miller in the country. Four of its five original mills, at Lambasa, Lautoka, the Rarawai mill at Mba and the Penang mill at Raki Raki, are still in operation. In 1962, following a growers' strike and contract

dispute, CSR formed a subsidiary company, South Pacific Sugar Mills Ltd. (SPSM), to take over operation of the four mills. SPSM became a public company in 1964 and CSR offered to sell shares in the company to Fiji residents, but was only able to sell about 2% of the issued capital. In 1969 Lord Denning was appointed as an independent authority to settle another contract dispute. His award, which the Government adopted in 1970 as the basis for a new ten-year contract between SPSM and the sugarcane growers, was generally welcomed by the growers but was unacceptable to CSR. Agreement was therefore reached in early 1971 on terms for the Government to buy CSR's interest in SPSM. The sale became effective on April 1, 1973 and the name of the company was changed to the Fiji Sugar Corporation Ltd. (FSC). FSC, which now has a statutory monopoly to manufacture raw sugar in Fiji, has maintained a technical and marketing arrangement with CSR which is due to expire after March 31, 1976. Arrangements have been made, however, for CSR to continue to provide technical assistance to FSC in certain critical areas. The Government has also established a wholly owned company, Fiji Sugar Marketing Co. Ltd, which has a tripartite marketing agreement with FSC and CSR whereby CSR will remain the sole marketing agent for Fiji export sugar until March 31, 1977. An assurance was obtained that FSC would continue to maintain appropriate arrangements to ensure technical and marketing efficiency. On the field side, FSC provides inputs on credit, research, extension services, controls pests and diseases and organizes harvesting and transport of cane to mill. The FSC Board reports to the Minister of Agriculture, Fisheries and Forests who may, after consultation, give the Board directions on general matters of policy.

2.07 Financially, FSC (and its predecessor, SPSM) has remained modestly profitable and has been able to maintain annual dividend payments and provide for expansion after meeting current expenditures and corporate tax obligations. The average net profit after tax from 1968 to 1974 was F$1.5 million, or 6.7% of average shareholders' equity. For the same period, the return on total assets employed averaged 4.6%, while dividends received by shareholders averaged 7.1%. Although FSC's profitability might be considered low by the standard of private companies in the industry, this results from political pressure to maximize the growers' share of sugar sale proceeds (para 6.05) rather than from any inefficiencies of operation. Since the Government owns 98% of the shares, low or even no dividends could be justified as reflecting the Government's intention to make rural life more attractive. On the other hand, care must be taken to ensure that FSC has sufficient resources in the future to meet its current obligations and provide for replacement, modernization and expansion to maintain its competitive position in the world sugar market.

Institutions

2.08 In addition to FSC, a number of other institutions provide services to farmers in sugarcane areas. The Ministry of Agriculture, Fisheries and Forests (MAFF) is responsible for all agricultural development activities in Fiji including research and extension for all crops other than sugarcane. The Drainage and Irrigation Division (DID) of the Ministry's Department of

Agriculture is responsible for irrigation in rice producing areas and rehabilitation and improvement of drainage works and seawalls throughout the country. DID works in conjunction with seven statutory Drainage Boards set up to maintain and improve drainage works in defined areas.

2.09 The Public Works Department (PWD) is responsible for construction and maintenance of all roads in Fiji down to country road standard. Its Roads and Airfield Division, headquartered in Suva, provides designs while the Operations Division, through its Divisional Roads Engineers in each geographical division, constructs and maintains the works.

2.10 The Native Land Trust Board (NLTB) is a statutory authority which administers all native land on behalf of its Fijian owners (para 2.12-2.13). The Native Land Development Corporation (NLDC) is a wholly-owned subsidiary of NLTB recently formed to implement NLTB's new policy to become actively involved in the development of native lands, both rural and urban.

2.11 The Fiji Development Bank (FDB) is an independent statutory authority, wholly owned by the Government with the duty to promote the economic development of Fiji within the framework of the Government's general economic plans, policies and priorities. It has an authorized capital of F$8 million (US$9.5 million) and a paid-up capital of F$4.6 million, wholly contributed by the Fiji Government. Total borrowings as of June 30, 1975 were F$3.5 million including F$1.0 million disbursed from an Asian Development Bank loan of US$2.0 million approved in 1973. The rest of its borrowings are from various local financial institutions.

Land Tenure and Farm Size

2.12 Some 83% of Fiji's total land area or about 3.8 million ac is owned communally by over 6,000 Fijian land owning units called "mataqali". 1/ About 10% of this "native land" is reserved for the exclusive use of Fijians, while the remainder may be used by members of any race with the consent of the mataqalis. Other land is either freehold (10%) or Crown Land (7%).

2.13 Native land may be leased but not sold. Fiji Indians own less than 2% of the land but farm some 450,000 ac of the best land in the country, including most of the sugarcane land, under leases from NLTB, the Crown or freehold owners. FSC only awards sugarcane contracts to farmers with freehold ownership or individual leases, and not to mataqalis. Therefore Fijians as well as Indians must secure agricultural leases, mostly from NLTB, in order to grow sugarcane. NLTB leases include provision for good cultivation and soil conservation practices. Maximum rent is 6% of the unimproved value of the land subject to reassessment every five years. NLTB may retain 25% of the value collected as a service fee; the remainder goes to the owning mataqali for distribution among its members.

1/ Pronounced "ma-tang-ga-li". There are other types of group registration but the mataqali is by far the most important.

2.14 Agricultural leases are subject to the Agricultural Landlord and Tenant Ordinance, which provides that leases for seasonal crops operate for a minimum of ten years with two extensions, subject to a claim of greater hardship by the owner. In practice the minimum term has become the standard, and has led some observers to conclude that the land tenure system discourages investment in and maintenance of improvements to the land, encourages land "mining" and generally hampers agricultural productivity. Land tenure is a major political and social issue in Fiji which the leaders of both the Fijian and Indian communities have been trying to solve since before independence. NLTB has stated publicly that it would consider granting standard 30-year leases for seasonal crops if the Agricultural Landlord and Tenant Ordinance were appropriately changed. Proposed changes to the Ordinance are currently before Parliament and the Council of Chiefs, and one of the results is likely to be a major increase in the standard term of agricultural leases.

2.15 Although the small farm leasehold pattern was established over 50 years ago, prohibition against subdividing leasehold land through inheritance or sale without official consent has prevented the evolution of a large number of small, fragmented holdings, so common in many countries. Farm size distribution is therefore quite uniform within the cane growing areas, although the average contract area for Indians (11.1 ac) is larger than that for Fijians (7.7 ac) due to generally better production performance. Despite the uniform farm size distribution, however, population pressure in some areas has led to a situation where two or more related families commonly live on and cultivate one farm.

Project Formulation

2.16 In its Development Plan VII (1976-1980) (DPVII), the Government gives high priority to improving the performance of agriculture. A major thrust of this strategy is to improve the attractiveness of agricultural occupations and to increase the participation of native Fijians in commercial agriculture. The basic objectives of the plan are to increase agricultural output both for export and domestic food consumption; to create rural employment opportunities; to raise farm incomes; and to improve the quality of rural life relative to that in urban areas.

2.17 As a major departure from the preceding plan which gave the sugar industry a passive role, during DPVII sugar is expected to play a dominant part in Fiji's overall development. A major expansion program is underway to open new lands for sugarcane production, to reclaim lands on which production has fallen due to poor drainage, and to raise productivity on existing cane lands. Programs other than for sugar include the establishment of estates on native land to increase the participation of the mataqalis in commercial agriculture, the development of good agricultural land for settlement, diversification into priority crops and livestock, and improved marketing, handling and distribution facilities.

2.18 In support of the Government's new priorities, FSC began an investment program in 1973 to increase annual sugar production to 400,000 tons by

1980 and to modernize export handling facilities. Part of this program involves an increase in the annual capacity of the Lambasa mill on Vanua Levu from 65,000 to 90,000 tons, compared with actual 1974 production of about 45,000 tons. The expansion is being funded by FSC and work is proceeding on schedule with estimated completion by 1979. To meet this increase the Government and FSC initiated the settlement of about 800 farmers, half Indian and half Fijian, to produce 200,000 tons of sugarcane per year on a contract area of 12,000 ac at Seaqaqa, about 25 miles west of Lambasa. Seaqaqa is the only remaining large, uncultivated area in Fiji both climatically suited to growing sugarcane and accessible to an existing mill and port. However, other similar areas could be developed for sugarcane if major investments are made to expand mill capacity, or for other crops which may prove agronomically and commercially feasible. Besides increasing sugar production, the objectives of the settlement are to encourage Fijian participation in commercial agriculture and to establish a viable community based on the production of sugarcane at Seaqaqa. The lessons learned at Seaqaqa would be applicable to future attempts to increase the productivity of native land elsewhere in the country, and to further involve Fijians in modern agriculture.

2.19 Investigations have also shown that a further 200,000 tons of sugarcane could be produced annually by reconstructing seawalls and improving internal drainage on some 26,400 ac of low-lying coastal land. The areas affected by poor drainage contain some of the highest potential sugarcane land in Fiji, on which production has been falling for the last 10 or 15 years due to failure to maintain the water control structures. Drainage improvement is an obvious high priority investment which would yield quick returns; failure to arrest the deterioration of these areas would result in continued declines in production.

2.20 In formulating this first Bank-assisted project in the agriculture sector, the Government and Bank staff had three main considerations: (a) the priority of the project in its sectoral context; (b) the time required to identify and prepare a suitable project; and (c) the nature of the Bank's contribution. On the first two grounds it was decided that the project should be in the sugar industry, because of its central role in the DPVII strategy and because a number of activities suitable for Bank assistance were already in progress or at an advanced stage of planning. Within the sugar industry it was decided that the Bank could contribute most to increased cane production which would directly benefit the small growers, while FSC would concentrate its resources on mill expansion, improved handling facilities, other infrastructure improvements and improved extension services throughout the industry. The proposals for Bank assistance would meet about 40% of the planned 100,000 ton increase in annual sugar production, while the remaining 60% would come from other investments financed by FSC. In addition, at the same time it was decided to identify and prepare a project to help small farmers outside the sugar industry. Such a project has been identified and the Government is proceeding with preparation, assisted by the FAO/IBRD Cooperative Program and Bank staff.

III. THE PROJECT AREA

General

3.01 The project would consist of two separate components to be carried out in different kinds of areas with different investment needs. In the first component, farmers are being settled to grow cane on a single tract of largely unused land. The area is currently covered by forest and scrub and possesses little physical infrastructure. In the second component, coastal land which has been cultivated with sugarcane for many years has lost productivity due to saltwater intrusion and impeded drainage. The areas so affected are scattered along the northern and western coasts of the two main islands, mainly on Viti Levu. They have good internal infrastructure and are connected to existing mills by an efficient transportation system (Map 11851).

Climate

3.02 Fiji has a tropical oceanic climate with two well-defined seasons, being relatively dry from May to October and wet from November to April. The prevailing easterly to southeasterly winds and the mountainous topography of Viti Levu and Vanua Levu give rise to higher average rainfall on the southern and eastern sides of the main islands. The northern and western coastal plains, where the project areas are located, are in the rain shadow, which is more pronounced on Viti Levu than on Vanua Levu. Mean annual rainfall in the dry zones ranges from 70 to 90 in, with 75% falling in the six wet months. The rainfall pattern also shows wide variation from year to year. Mean temperatures range from 74° to 81°F with little daily or monthly variation (Annex 1). The islands are affected by periodic cyclones, but damage is seldom serious.

Seaqaqa Settlement

3.03 The settlement area covers some 40,000 ac on the Seaqaqa plateau of Mathuata province about 25 mi west of Lambasa, between the Ndreketi river and the north coast of Vanua Levu (Map 11852). There is currently only one small village in the area, Nanduri, about five mi north of the settlement. It is incapable of providing necessary services and a new town would be established as part of the project.

3.04 The area consists of rolling to hilly land crossed by small streams, lying about 250-500 ft above sea level. About half the area is of moderate slope suitable for cultivation. Another 25% could be developed for citrus or other tree crops with suitable soil conservation measures, while the remainder must be kept under forest. Most of the soils at Seaqaqa where sugarcane would be grown are red latosolic clays and clay loams. As a result of high rainfall, they are strongly leached, acid and deficient in nutrients. Except in a few areas, they are moderately deep and free-draining but erodible and of poor water retention capacity. They will need careful management and heavy fertilizer applications to yield satisfactorily.

3.05 Before 1974 the area was sparsely settled by about 150 Indian and 50 Fijian families whose production was limited to subsistence crops. In the last two years some 400 families, of whom about 250 are Indian and 150, Fijian, have been settled and 4,000 ac have been cleared and planted with sugarcane, using mechanical cultivation methods. An estimated 34,000 tons of cane were harvested during the 1975 crushing season from about 1,900 ac planted in 1974. Yields were quite variable but averaged about 18 ton/ac. In addition to sugarcane, each farm is being planted with about 1 ac of mixed citrus and 0.1 ac of pineapples for the local market. Subsistence rice, root crops and vegetables would be grown on small plots, mainly by women and children during the slack season, as is common throughout the sugar industry. The proposed farming activities could be handled by a smallholder settler and his family, using mechanical cultivation and supplementing family labor during the crushing season with hired labor which is available in the Lambasa area and from the outer islands. Agricultural practices and production at Seaqaqa are described in Annex 2.

3.06 The transportation network at Seaqaqa is currently inadequate to handle the 200,000 tons of cane expected from the area annually by 1980. A sugar tramline built and operated by FSC extends from the Lambasa mill to a terminal at Wailevu. From there the gravel-surfaced main road goes to Tambia, proceeds along the coast to Nanduri, climbs to the Seaqaqa plateau at Korovuli and continues west through the project area. The coastal road is steep, narrow and winding and presents a definite hazard to cane transportation, particularly at night and in wet weather. Less than 10 mi of farm access roads had been built by mid-1975. Transport from the field to pickup points on the main road is by rail truck on trailers pulled by farm tractors. Road vehicles then carry the cane trucks to the Wailevu tramline terminus.

3.07 During the 1975 crushing season cane transport between delivery points and the terminus ran into difficulties and delays because of the type of transport equipment used. The existing lorries only carried three cane trucks and were not provided with either winches or hydraulic gear to facilitate loading the trucks. The Project Manager, after a visit to Australian sugar areas, has developed with the assistance of a specialized equipment producer specifications for a six-axle semi-trailer suitable for Seaqaqa conditions. Three of these vehicles, each carrying five cane trucks, would be tested on a pilot basis during the 1976 crushing season commencing in May. About 65,000 tons of cane are estimated to be available from Seaqaqa during the season which would allow for a good test of the equipment. Experience with the semi-trailers would be reviewed by the Government and the Bank in September 1976 to determine the suitability of the equipment, the responsibility for operation and maintenance of a fleet of such vehicles and the procurement procedures for 1977 and subsequent years (para 4.22).

3.08 All land in the project area is native land. Settlers are each being given NLTB agricultural leases, and to encourage land improvement, NLTB and the local mataqalis have agreed to a uniform 30-year term as an exception to the normal practice of ten-year leases (para 2.14). Farms are

being laid out with a minimum of 15 and an average of 25 ac of arable land. Because of the hilly terrain, farm blocks have been averaging about 50 ac gross to ensure these amounts. Rent (para 2.13) is set initially at F$7.50/ac of sugarcane and F$0.50/ac for other land, subject to reassessment after five years. Settlers build houses on their own holdings using their own local building materials and galvanized roofing sheet provided by FSC. Due to topographic and soil differences, the potential income from the 15 ac on each farm to be developed for cane would be about the same as that from a 10-ac coastal cane farm (para 6.08). The 10 ac of arable reserve would be available for future development for sugarcane, subject to milling capacity, or for other crops which might prove technically feasible and commercially viable. In either case it is expected that additional family members would informally move onto the Seaqaqa farms to benefit from the eventual expansion in cultivated area.

Drainage Improvement

3.09 The drainage improvement areas include 20,100 ac or 20% of the total sugarcane land in the Lautoka, Rarawai and Penang mill areas of Viti Levu, and about 6,300 ac or 10% of the total cane area in the Lambasa mill area of Vanua Levu (Map 11851). The areas are close to major towns, have a good road system, much of which is bitumen-surfaced, and are served by FSC's sugar tramline system.

3.10 The areas are low-lying and flat. Some were originally mangrove swamp covered by sea water and were reclaimed at the turn of the century by the construction of seawalls and tidal gates. The rest are barely above high tide level. The soils are alluvial and are potentially among the best in Fiji. They have yielded well in the past and, with restoration of water control, should yield well in the future.

3.11 Areas affected by poor drainage fall into two distinct types. In the first, the protective seawalls, tidal gates and associated drainage systems have fallen into disrepair and the areas behind the seawalls are affected by saltwater intrusion and waterlogging. About 11,000 ac are affected, of which 3,400 ac have gone completely out of production. In the second type, higher land in flat valley bottoms farther inland is waterlogged due to deterioration of the internal drainage systems and siltation caused by run-off from the upstream catchments. About 17,400 ac are affected, of which 2,600 ac have gone out of sugarcane and are being cultivated under rice or left fallow for grazing. About 2,000 ac of the second category have already been improved, leaving 15,400 ac for improvement under the project.

3.12 In the drainage improvement areas, sugarcane is generally grown as a monoculture. Cultivation is mainly by bullocks but tractors are being used increasingly, particularly for first plowing before the rains begin. Yields in these areas are potentially in excess of 30 ton/ac due to flat topography and good soils, but actual yields now average only 18 ton/ac harvested due to poor management, particularly on Fijian farms, and poor

drainage. Total cane production from the drainage improvement areas is currently about 350,000 tons per year. Agricultural practices and production are described in Annex 3.

3.13 No details are available on crops other than sugarcane. Some paddy is grown mainly as a subsistence crop, often on land out of cane production due to drainage problems, or after a final ratoon crop of cane. Paddy yields are low, averaging about 0.75 ton/ac. Limited areas of vegetables, mainly for home use, are also grown.

3.14 Transportation of cane to the mills is generally by rail, although road transport has to be used in some areas remote from FSC's tramline. As is true throughout Fiji, cane transport costs for rail are borne by the miller while those for road are borne by the grower. Most of the main roads are bitumen-surfaced. Field transport is generally by rail truck on portable lines pulled by bullocks. The service is adequate and no improvement would be necessary under the project.

IV. THE PROJECT

General

4.01 The proposed project would consist of two parts, both of which are aimed at increasing sugar production for export and raising the incomes of cane farmers. The first part would complete the ongoing settlement scheme at Seaqaqa while the second would improve drainage on low-lying coastal sugarcane lands. Project works are described in detail in Annexes 2 and 3 and summarized in the following paragraphs. Project components would include:

(a) Seaqaqa Settlement

(1) clearing of about 8,000 ac of scrub and forest-covered land for planting sugarcane;

(2) provision of housing material, land preparation, inputs up to first harvest and first year subsistence loans for about 400 new settlers;

(3) construction of a 6.5 mi sugar tramline extension from Wailevu to the foot of the Seaqaqa plateau at Tambia;

(4) construction and upgrading of about 17 mi of main roads from Tambia to the western edge of the project area at Vunimako;

(5) construction of about 117 mi of farm access roads to serve each farm;

(6) provision of sites and services for a new township at Seaqaqa;

(7) construction of a road maintenance sub-depot at Seaqaqa township;

(8) loans from FDB to individual settlers and NLDC for the purchase of tractors, farm implements and sugarcane transport vehicles; and

(9) procurement of road construction and maintenance equipment.

(b) Drainage Improvement

(1) reconstruction of about 22.5 mi of seawalls with tidal gates;

(2) improvement of internal drains serving about 26,400 ac of sugarcane land;

(3) photogrammetric mapping of the drainage areas on Viti Levu; and

(4) procurement of vehicles and construction of offices.

Seaqaqa Settlement

4.02 The Seaqaqa settlement was begun in 1974 and will eventually involve 800 farmers on a contract area of 12,000 ac. By mid-1975 some 400 farmers had been settled and 4,000 ac had been cleared and planted to sugarcane. Another 400 families would be settled in the area under the project on the same terms as those already settled, and a further 8,000 ac of cane would be developed.

4.03 Owing to the broken nature of the land, much of which is too steep for sugarcane, a much larger area than 12,000 ac must be opened up so that each settler can be given a block of at least 15 ac suitable for growing cane. The opportunity is therefore being taken to plan and implement the comprehensive development of the whole plateau as a new community based economically on sugar with the possibility of other crops later. A new township is being built to serve the area. It is expected that about 100 families (500 people) would eventually reside there permanently. Initial facilities are being provided for about one-third that number, who will be directly associated with the project, with room for expansion as required. FSC's sugar tramline is being extended to the base of the plateau at Tambia, from where a new main road would be built to the eastern edge of the settlement area at Korovuli, thereby shortening the present steep and winding coastal route. From there the existing main road would be upgraded, fed by new access roads to each farm.

4.04 Half the settlers would be Fijian and half Indian. Selection is made by a committee comprising the Seaqaqa Project Manager (para 5.02), the Northern Divisional Planning Officer, the Manager of the Native Land Trust Board (Lambasa), the chief executive officer of the Mathuata Provincial Council and a representative of the mataqalis in the settlement area. For primarily social reasons, priority is given to (a) farmers living in the area, (b) evictees of native or Crown Land, (c) persons chosen by native landowners and (d) sons of local farmers with uneconomic sized holdings. In the case of other applicants, preference is given to those (e) between 21 and 45 years of age, (f) with the necessary farming knowledge and skills, (g) having no other source of income, (h) coming from an economically depressed area as a result of land pressure, (i) willing to live on their own farms and (j) with no other land.

4.05 One of the objectives of the Seaqaqa settlement is to involve native Fijians more actively in sugarcane and other commercial agricultural activities. To this end, NLDC would operate 37 of the 400 farms allocated to Fijians in one block as a nucleus estate covering about 1,600 ac gross (including 1,200 ac suitable for sugarcane), of which 200 ac were under cane as of mid-1975. NLDC would also operate a tractor hire and cane transport business at Seaqaqa, with a maintenance workshop, and would develop the new Seaqaqa township. NLDC's main objectives would be to train Fijians as cane farmers on the estate; to develop the most profitable field operational techniques applicable to smallholder cane farmers; to set a standard of agricultural excellence, including soil conservation measures; to train Fijians to operate tractors and cane transport equipment so that they can play their full part in the settlement either as NLDC employees or as independent operators alongside Indian contractors; and to provide economic and social services for the farming community through the development of Seaqaqa township, while giving Fijians a roughly equal opportunity to provide those services. Finally, NLDC would have the power to take over and maintain under its estate management the farms of any settlers who fail as smallholders, until they or their successors are adequately trained on the estate. An assurance was obtained that NLDC would consult with the Bank before undertaking any major expansion of the area under its estate management through the takeover of unsuccessful farms, or before distributing any part of the existing estate to individual smallholders.

Status of Engineering

4.06 At the time of appraisal, land clearing at Seaqaqa was carried out on an hourly plant hire basis under FSC's supervision following land capability studies and subdivisional surveys by the Department of Agriculture and NLTB. FSC has since engaged a local consulting firm to measure plant output and to determine the best methods of land clearing by contract. This information would form the basis for drawing up specifications to be incorporated in tender documents for project works.

4.07 PWD has surveyed the alignment of the Tambia-Korovuli main road and its Roads and Airfield Division is proceeding with design for road works and bridges according to Main Road Standards (Annex 2), to be completed by the end of 1975. Designs would be reviewed by Bank staff during project

supervision. The farm access roads are set out on the ground in the course of subdivision. Construction is carried out to PWD Country Road Standards (Annex 2) without further design work.

4.08 NLDC is coordinating the overall layout of the new Seaqaqa township with the Directorate of Town and Country Planning, and has engaged a local consulting firm to assist with engineering and design work. Township roads would be built to PWD Country Town Standards. Water supply would be pumped from the Ndreketi river and the design includes storage, treatment, gravity feeding and reticulation. The consultants are coordinating design of the electricity supply with the Fiji Electricity Authority, which would provide the distribution system.

4.09 DID has completed detailed designs for 1,800 ac of improved drainage and associated seawalls at Wailevu. The Division is expected to complete the detailed survey of a further 1,600 ac on Vanua Levu and the detailed design of 2,000 ac on Viti Levu by the end of 1975. Further survey and detailed design work must await mapping of the drainage areas on Viti Levu and agreement from the local Drainage Boards to carry out specific works as part of the DID's annual work program (para 5.09).

Implementation

4.10 Land clearing and first year farm development at Seaqaqa have been proceeding at the rate of about 2,000 ac per year and would continue at that rate until completion by the end of 1979. Although the easiest areas were cleared and planted first, it is expected that the increased difficulty of clearing land under denser cover would be offset by increased efficiency of operations as time goes on. Construction of the tramline extension began in September 1975 and is scheduled to be completed by August 1976 (para 4.18). Construction and upgrading of the main road at Seaqaqa would take two years beginning January 1976, while farm access roads would be constructed over four years beginning January 1976 to keep pace with land clearing; all land rights required for road construction have already been obtained. Credit for tractors, farm implements and cane transport vehicles would be coordinated with the demand for contract services at Seaqaqa and spread over four years. Seaqaqa township development would be carried out over two years beginning mid-1976. Seawall reconstruction would take four years and internal drainage improvements, five years beginning April 1976 (Chart 15164).

Cost Estimates

4.11 Total project costs are estimated at US$26.0 million, of which US$12.0 million or 46% is foreign exchange. Base costs were estimated using January 1976 prices and would cover all expenditures beginning January 1976, except for the tramline extension which would be covered from September 1975. For the Seaqaqa settlement, land clearing and farm development costs are based on the cost of similar work already carried out in the area. The tramline extension estimate is based on the winning bid for earthworks (para 4.19), and FSC estimates for track laying. Road costs are based on PWD standards and unit rates, and prices for construction equipment quoted for

1976 delivery. Tractor and cane transport costs are based on local prices quoted for 1976. Township development costs are based on NLDC estimates. Costs for seawall reconstruction and internal drainage improvement are based on quantities obtained from detailed design of an 1,800 ac sample area and unit rates updated to January 1976. Physical contingencies of 10% for the Seaqaqa settlement and 20% for the drainage improvements are related to the degree of investigations completed to date. Costs due to expected price increases amount to about 20% of total project costs and assume the following annual inflation rates:

Annual Inflation Rate (%)

	1976	1977-79	1980
Civil Works	14	12	10
Equipment and Services	10	8	7

4.12 Details of the project costs are presented in Annex 4 and are summarized below:

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange
	(F$ million)			(US$ million)			%
Seaqaqa Settlement							
Land Clearance & Farm Development	1.1	0.7	1.8	1.3	0.8	2.1	38
Tramline Extension	0.6	0.3	0.9	0.7	0.4	1.1	36
Roads	2.4	3.4	5.8	2.8	3.9	6.7	58
Tractors & Cane Transport	0.4	0.9	1.3	0.4	1.1	1.5	73
Township Development	0.5	0.3	0.8	0.6	0.4	1.0	40
Engineering, Supervision & Adm.	0.9	-	0.9	1.1	-	1.1	-
Sub-total	5.9	5.6	11.5	6.9	6.6	13.5	48
Drainage Improvement							
Seawall Reconstruction[/a]	0.9	0.8	1.7	1.0	0.9	1.9	47
Internal Drainage	1.3	1.0	2.3	1.5	1.2	2.7	44
Engineering, Supervision & Adm.	0.3	-	0.3	0.4	-	0.4	-
Sub-total	2.5	1.8	4.3	2.9	2.1	5.0	42
Base Cost Estimate	8.4	7.4	15.8	9.8	8.7	18.5	47
Physical Contingencies	1.1	0.9	2.0	1.3	1.1	2.4	46
Expected Price Increases	2.5	1.9	4.4	2.9	2.2	5.1	43
Total Project Cost	12.0	10.2	22.2	14.0	12.0	26.0	46

/a Includes mapping, offices and vehicles.

Financing

4.13 Funds for carrying out the project would come from four sources. The proposed Bank loan of US$12.0 million (F$10.2 million) would finance the full foreign exchange costs. To finance the local costs, the Government would provide US$7.3 million (F$6.2 million) out of annual budget appropriations, while FDB would provide US$6.0 million (F$5.2 million) and FSC would provide US$0.7 million (F$0.6 million), each from its own resources.

4.14 A subsidiary loan agreement would provide for the on-lending of US$6.0 million (F$5.2 million) from the Government to FDB on the same terms as the Bank loan, except that an assurance was obtained that the Government would bear the foreign exchange risks. FDB would further lend that amount plus the equivalent of US$6.0 million of its own resources, (a) to Seaqaqa settlers for land clearing and first year farm development and subsistence; (b) to FSC for the tramline extension; (c) to settlers, other contractors and NLDC for tractors, farm equipment and cane transport vehicles; (d) to NLDC for its estate and Seaqaqa township development; and (e) to Drainage Boards for internal drainage improvements. An assurance was obtained that the Government would make arrangements satisfactory to the Bank to ensure that FDB has sufficient funds for carrying out its responsibilities under the project. The Government would use the remainder of the Bank loan (US$6.0 million) plus its own resources to finance the roads at Seaqaqa, seawalls and tidal gates.

4.15 Since the Seaqaqa settlement is an ongoing project, it is proposed that expenditures incurred beginning January 1, 1976 would be eligible for Bank assistance, with the exception of the earthworks for the tramline extension, for which retroactive financing to September 1975 is proposed (para 4.18). About US$550,000 of retroactive financing would be involved, including US$350,000 for the tramline.

4.16 The cost of land clearing, farm development and annual inputs at Seaqaqa would be borne initially by FSC. For each settler, FDB would reimburse FSC for all development costs up to first harvest, and for land clearing costs in subsequent years, and would debit the settler's account by the same amount. The Project Manager (para 5.02) would certify the physical progress and cost of land clearing and first year farm development, and settlers would sign an agreement with FDB to reimburse FSC on their behalf, before the transaction takes place. In order to administer the loans, as well as to provide additional credit to settlers, FDB proposes to open a new branch office at Seaqaqa township.

4.17 FDB recently raised its interest rate on agricultural loans from 9% to 10%, compared with an expected annual inflation rate of 7%. In May 1974, the Government decided to subsidize certain agricultural loans in order to stimulate agricultural development and help redress urban-rural income imbalances. Eligible farmers pay an interest rate of 4% to 6% and the Government pays the difference between the farmer's rate and FDB's current lending rate. Seaqaqa settlers, in common with other sugarcane farmers for similar

type loans, would be eligible for FDB loans at subsidized interest rates for land clearing and first year farm development. Loans for the purchase of farm tractors are also generally eligible for an interest rate subsidy. However, since it is expected that only the more successful settlers would apply for tractor loans, and in order not to distort relative factor prices and overly encourage a capital intensive technology to develop at Seaqaqa, an assurance was obtained that tractor loans under the project would be at FDB's normal interest rate for agricultural loans. FDB's terms for lending under the project would be as follows:

(a) loans to Seaqaqa settlers for land clearing and preparation, roofing sheets, inputs up to first harvest and first year subsistence loans would be at 4% for a maximum of ten years, including a grace period not exceeding three years;

(b) loans for purchase of tractors would be at 6% for a maximum of ten years;

(c) loans to settlers and other contractors for farm equipment and cane transport vehicles would be at 10% for not more than ten years;

(d) loans to NLDC for estate development, farm equipment, cane transport vehicles and township development would be at 10% with different maturities as agreed between FDB and NLDC, maturities would not exceed 20 years;

(e) the loan to FSC for the tramline extension would be at 10% for 20 years; and

(f) loans to Drainage Boards for internal drainage improvements would be at 10% for ten years.

A proposed condition of effectiveness of the loan would be that a subsidiary loan agreement, satisfactory to the Bank, had been concluded between the Government and FDB. Draft terms of the agreement have been finalized by the Government and discussed with the Bank.

Procurement

4.18 Civil works for the various components of the project would be carried out under arrangements that would maximize the use of local contractors, while still getting the work done on time and without overextending their capabilities. Foreign contractors have been uncompetitive because of the relatively small size of the works and the remoteness of the country. The lowest foreign bid for the tramline earthworks (para 4.19) was 65% above the successful local bid. Civil works for land clearing, seawall reconstruction and internal drainage improvements would be executed by local contract and would keep local contracting capability fully engaged. The road components of the project would be implemented by PWD force account, which does all similar road work. The road equipment financed under the project, with an

estimated residual value of US$650,000, would be used by PWD to complete the transinsular road from Lambasa to Savusavu now under construction and for other high priority road works under DPVII.

4.19 Earthworks for the tramline extension (US$0.8 million) are being carried out under contract awarded after international competitive bidding in accordance with Bank Group guidelines for procurement. After Bank review, the contract was awarded in September 1975 to a local construction firm which had the necessary qualifications and was the lowest bidder. Retroactive financing would be appropriate to maintain the project's momentum and ensure that cane transport does not become a bottleneck to the realization of project benefits. Bridges on the tramline would be constructed by FSC staff, who would also install sleepers, ballast and rails using materials already on hand.

4.20 Civil works for land clearing (US$1.7 million), seawall reconstruction and internal drainage improvements (US$4.5 million) would be carried out under contracts awarded after competitive bidding in accordance with local procedures, which have been reviewed by Bank staff and are acceptable. Contracts for land clearing would be unlikely to exceed US$100,000 each. The largest contract for seawalls and internal drainage would be about US$400,000, while most such contracts would be around US$100,000. The small, scattered nature of these works makes them unsuitable for international competitive bidding. There is adequate competition and foreign firms would be eligible to participate in the bidding.

4.21 Civil works for the roads at Seaqaqa (US$5.4 million) and for township development (US$0.4 million) would be carried out by PWD force account. The small amount of main road construction and improvement and the scattered nature of the farm access roads makes them unsuitable for international competitive bidding. In addition, past experience with international competitive bidding for roads in Fiji has shown that foreign bids have been considerably higher than the cost of PWD force account work, due to the size and location of the country and the difficulty of mobilization. It is expected that the local contracting industry would be fully extended with land clearing, seawall reconstruction and internal drainage improvements under the project, as well as other ongoing development work in Fiji, and would therefore be incapable of carrying out the road works on time.

4.22 Equipment for construction and maintenance of roads at Seaqaqa, and for electricity and water supply (US$1.8 million) would be procured after local shopping in accordance with local procedures, which have been reviewed by Bank staff and are acceptable. International competitive bidding for such equipment would not be warranted because of the small number and diversity of items involved, the desirability of standardization with existing PWD equipment and the advantage of existing servicing arrangements with local suppliers. A detailed equipment list is given in Annex 5.

4.23 Tractors and farm implements (US$0.6 million) for use in the Seaqaqa settlement area would be purchased after local shopping by borrowers with

credit to be advanced by FDB. There are enough local suppliers to ensure adequate competition and after-sale service. All items would be certified by the Seaqaqa Project Manager as being required for the project. Three specially designed cane transport vehicles (US$0.2 million) would be purchased from the supplier. Procurement arrangements for ten more such vehicles (US$0.7 million) would be determined after review by the Government and the Bank (para 3.07).

4.24 Photogrammetric mapping (US$0.1 million) would be carried out by the Lands Department.

Disbursements

4.25 The Bank loan would reimburse the Government for expenditures falling into two general categories -- those financed through FDB (US$6.0 million) and those financed directly by Government departments (US$6.0 million). Disbursements would be made at the rate of 100% of foreign exchange cost for directly imported equipment, 70% of total cost for imported equipment procured locally and 45% of certified monthly progress payments or expenditures for civil works. It is expected that disbursements would be completed by December 31, 1981, approximately one year after the end of all construction. An estimated schedule of expenditures on the project, a semi-annual disbursement schedule and the proposed allocation of loan proceeds are given in Annex 6.

Accounts and Audit

4.26 Assurances were obtained that the Government would set up a separate Treasury account for the project for disbursement of all Government and Bank funds; that MAFF, PWD, and FDB would each set up separate accounts for their respective parts of the project which the Permanent Secretary, Finance would combine into a single consolidated account; that the Government's Auditor General or other auditors satisfactory to the Bank would be employed to audit the consolidated project account annually; and that the Permanent Secretary, Finance would send the audited account, together with the auditor's comments, to the Bank within four months of the close of each financial year. The accounts for FDB would include experience on loan recoveries and would extend until all loans under the project have been repaid. In addition, FDB, NLDC and FSC would submit their overall audited accounts to the Bank annually through the Permanent Secretary, MAFF. Information on the experience of Drainage Boards in collecting drainage rates (para 5.07 and 5.21) would be included in monitoring indicators (para 5.17).

Environmental Effects

4.27 There is no schistosomiasis or malaria in Fiji. Filariasis is under control and its eradication is the object of a current public health campaign. The disease is most prevalent in swampy areas of Vanua Levu and parts of Viti Levu, and drainage improvements under the project should help reduce its incidence. Enteric diseases are common among children. The Medical Department with UNDP assistance is carrying out a program to provide

20,000 water seal toilets over four years to improve sanitation in rural areas.

4.28 The major potential environmental hazard from the project is soil erosion in the Seaqaqa settlement area, due to a combination of highly erodible soils, intense rainfall and irregular topography. However, all agencies involved in the scheme are acutely aware of the problem and are taking adequate measures to ensure that excessive erosion does not occur. NLTB agricultural leases provide sufficient legal restrictions against improper land use, and the Seaqaqa Project Manager is empowered under the leases to enforce these restrictions. Bank staff have reviewed the soil erosion control standards and they are adequate. Field observations indicate that they are being enforced in the settlement area.

V. ORGANIZATION AND MANAGEMENT

5.01 The Permanent Secretary, MAFF would be responsible for project implementation. The two parts of the project would be carried out independently under his overall direction.

Seaqaqa Settlement

5.02 The management organization for the Seaqaqa settlement is shown in Chart 15154(2R). The Permanent Secretary, MAFF would be chairman of a central coordinating committee responsible for policy in the settlement area. The committee would include national level representatives of FSC, NLTB, NLDC, FDB, PWD, the Ministry of Finance, the Ministry of Fijian Affairs and Rural Development, together with the chairman of the local coordinating committee (para 5.04) and the Project Manager. Responsibility for implementing the settlement would rest with a Project Manager who would be appointed by and report to the Permanent Secretary. A qualified and experienced FSC employee seconded by CSR under the technical services agreement (para 2.06) has been filling the role of Project Manager since the settlement's inception, and his contract has been extended at least until the end of March 1977. If he decides to leave then, there would be enough time to find and train a suitable replacement. An assurance was obtained that the Government would continue to employ a person, with qualifications, experience, powers and responsibilities acceptable to the Bank, as Seaqaqa Project Manager.

5.03 On the field side the Project Manager would have two principal subordinates - a Cane Development Officer provided by FSC and an Agricultural Officer provided by the Department of Agriculture for other subsistence and commercial crops. The Cane Development Officer would control the extension staff, set up and manage farm accounts, and organize the harvest and transport of cane. He would also direct a Land Clearance Unit to carry out all land clearing under contract. The local consulting firm employed by FSC (para 4.06) would be attached to the Land Clearance Unit to prepare tender documents, supervise the work and prepare monthly progress certificates. The Project Manager would award all contracts.

5.04 The Project Manager would coordinate other project activities such as survey, road construction and social services through a local coordinating committee chaired by the Commissioner, Northern Division. The local committee would contain division level representatives of all departments and agencies involved in the project, as well as a representative of the mataqalis in the area and the chief executive officer of the Mathuata Provincial Council.

5.05 A PWD construction unit under the Department's Northern Divisional Engineer (Chart 15155(3R)) would construct project roads by force account. An assurance was obtained that PWD would employ a road engineer, with qualifications, experience, powers and responsibilities acceptable to the Bank, whose primary responsibility would be to head the unit. The project would include a road maintenance sub-depot at Seaqaqa township which would serve as a construction camp during the implementation period. An assurance was obtained that PWD would adequately maintain all project roads, and that the Government would provide all funds required for the purpose.

Drainage Improvement

5.06 The Permanent Secretary would carry out the drainage improvement part of the project through DID in conjunction with local Drainage Boards (para 2.08). DID would carry out all construction and maintenance of seawalls and internal drains by contract. The Division would finance seawall reconstruction from its own budget and would act as agent for the Drainage Boards for construction of internal drains and all operation and maintenance.

5.07 There are seven Drainage Boards empowered under the Drainage Ordinance to maintain, improve and construct drainage works, enter into contracts, control livestock, conduct surveys and undertake other matters relating to drainage works. The Boards have the power to levy drainage rates which, together with any grants, are paid into a Drainage Fund. In sugarcane areas, drainage rates may be collected by FSC by deduction from cane payments. The Boards would apply to FDB for loans to finance construction of internal common user drains, and would collect drainage rates from beneficiaries to repay these loans as well as to finance O&M of both seawalls and internal drains (para 5.21).

5.08 With its central headquarters and functionally oriented field units, DID is now geared primarily to carrying out rice irrigation projects; drainage work is limited to a small design unit based in Lautoka. To fulfill its increased drainage responsibilities under the project, DID is in the process of setting up and staffing a Central Design Office at headquarters and two regional offices in the Northern and Western Divisions (Chart 15156(R)).

5.09 The Principal Engineer, Drainage and Irrigation would have overall responsibility for drainage improvement work to be carried out under the project. He would be responsible for coordinating planning, survey and design

work and for drawing up annual work programs. To maintain a continuous flow of work, an assurance was obtained that, not later than three months before the start of each financial year, DID would prepare an annual work program for drainage improvement, having obtained agreement from the respective Drainage Boards to carry out the proposed works.

5.10 Divisional Engineers would head the regional offices and would be responsible for all irrigation and drainage works within their divisions. They would be supported by the Central Design Office for survey, major design and contract administration services. The two Divisional Engineer posts have already been established, but they are still vacant; they are expected to be filled by April or May 1976. Assurances were obtained that the regional offices would be set up and suitably staffed, and that suitably qualified and experienced engineers, with powers and responsibilities acceptable to the Bank, would be appointed to fill the Divisional Engineer positions, before any contract work on the drainage improvement part of the project is carried out.

Supporting Agricultural Services

5.11 FSC is responsible for sugarcane research and runs a well organized experiment station at Lautoka covering plant breeding and variety testing, agronomy, and diseases and pests. Cane breeding and variety testing are on a par with the other recognized breeding stations of the world. The three main varieties currently grown in Fiji--Ragnar, Waya and Mali--have the advantages of disease resistance, high sucrose content and good milling qualities, but they are not high yielding. New varieties are therefore being developed, which have higher yields but maintain the advantages of the traditional varieties. The station has recently introduced proven commercial varieties into the breeding program and this holds promise of producing new varieties quickly. The agronomy section takes soil and leaf samples from each field and analyzes them to determine fertilizer needs. Strategically placed experiments are laid out periodically to confirm the results. The station's pathologist screens varieties for disease resistance and is in charge of testing fungicides and herbicides. In conjunction with the entomologist he is studying the factors affecting the development of leaf hoppers which are the vector of Fiji disease. Biological control of the vector is carried out by Tytthus mundulus. The entomologist is also studying beetle borers and hornets in association with the Commonwealth Institute of Biological Control. The station has done some work in cultivation but more effort is needed, particularly on the time of planting, land preparation operations and the value of the trash blanket.

5.12 FSC has just established a small research station at Seaqaqa to concentrate on new technical developments specifically adapted to the settlement area. Work is currently being carried out to determine specific fertilizer recommendations based on detailed soil analysis supported by leaf analysis of first plantings. Research would also be carried out on the use of washed coral sand to neutralize soil acidity and the cumulative effects of acidic fertilizers.

5.13 The Department of Agriculture runs a research station at Seaqaqa for crops other than sugarcane, which provides farmers with seeds and planting materials for subsistence food crops. Experimental work has been carried out on citrus with encouraging results, and proven planting material is available. To date, farmers have been encouraged to plant 1 ac of mixed citrus and 0.1 ac of pineapple per farm for the local fresh fruit market. Trials have also been conducted on a number of other crops.

5.14 FSC maintains a strong field staff to assist farmers with management practices, and to control disease. Through approval and treatment of seed cane and a vigorous program of finding, removing and destroying diseased cane, FSC has virtually eliminated Fiji disease and downy mildew, and maintains a close watch to prevent their recurrence. There are a number of other diseases of minor importance. Pests are not a problem except rats in some areas near rivers. The Government permits the use of anticoagulant poisons as a control measure. The field organization also organizes the harvest and transport of cane to mill. The cane growing areas are currently divided into 33 sectors, each under the responsibility of a field officer who is primarily concerned with harvesting and transport. Each field officer controls a farm advisor who visits farmers and advises on field practices. There is one farm advisor to about 500 farmers. Extension work is concentrated on inexperienced and less successful Fijian farmers and Indians with specific problems.

5.15 In the special case of Seaqaqa, where the problems of new settlement and a large number of inexperienced farmers will have to be faced, a denser coverage of farm advisors would be required, particularly during the development period. In addition to sugarcane, the farm advisors would also help settlers to establish small subsistence food plots and limited plantings of citrus and pineapples with planting materials and inputs provided through the Department of Agriculture. An assurance was therefore obtained that FSC, with seconded staff from the Department of Agriculture as required, would provide one farm advisor for not more than 100 settlers during the first four years of the project, and that the Government would consult with the Bank before reducing the farm advisory staff in the settlement area thereafter. Under this formula a total of eight farm advisors would be required.

5.16 FSC provides cane farmers with seed cane, fertilizers and advances for the cost of harvesting by gangs and transportation of cane from the field to delivery points. The amount advanced is recovered as a first charge against the grower's share of sugar sale proceeds.

Monitoring Benefits

5.17 A monitoring unit would be set up in the Economics, Planning and Statistics Division of MAFF, which reports directly to the Permanent Secretary. It would be responsible for monitoring such aspects of the project's progress as deployment of farm advisors, pace of land clearing and farm development, progress of drainage improvement, yield progression, farm incomes, loan repayment and drainage rate collections. The unit would

work closely with FSC, which routinely collects most of the necessary data, and would conduct supplementary surveys as required.

Cost and Benefit Recovery

5.18 Annex 9 examines the implications for public revenues and project beneficiary incomes and incentives of the Government's proposed cost recovery policies for various project components. The analysis is presented in terms of three indices which are defined as follows:

(a) Cost Recovery Index: the ratio of incremental direct payments for the project by all project beneficiaries to incremental project construction, operation and maintenance costs;

(b) Benefit Recovery Index: the ratio of incremental direct payments for the project by a typical farm family to incremental income accruing to the family before paying project charges; and

(c) Rent Recovery Index: the ratio of incremental direct payments for the project by a typical farm family to incremental "project rent" accruing to the family before paying project charges, where "project rent" is defined as incremental income as in (b) less the value of family labor, management costs and allowances for uncertainty.

All project charges, costs and benefits are measured at present values discounted at 10% annual rate of interest over the period of repayment and in terms of constant 1975 prices. It is assumed that there would be no incremental payments of general taxes due to the project. The numerical results are summarized in the following table:

	Cost Recovery Index	Benefit Recovery Index	Rent Recovery Index
		%	
Seaqaqa settlement	27-53	34	100+
Drainage Improvement	46-78	25-46	62-100+

5.19 For the Seaqaqa settlement, the analysis was limited to land clearing, first year farm development and farm access roads. The main road would be part of the national highway system and all users including the settlers and township residents would be subject to Fiji's normal road user charges. The cost of the tramline extension would be borne by FSC from its share of sugar sales. The cost of tractors and cane transport vehicles would be fully recovered from FSC, individual purchasers and NLDC at an interest rate of 10%. The cost of township development would be borne by NLDC, which would operate as a commercial developer and would recover its

full investment costs from township residents. Progress on NLDC cost recovery would be followed up during project supervision.

5.20 Settlers would repay FDB directly for the full cost of land clearing and first year farm development over an average of five years and a maximum of seven years at 4% interest beginning in year four. Many farmers settled during the first two years have been repaying their loans more quickly due to the high sugar prices of 1974 and 1975, and FDB would continue to encourage all settlers to do so. Assuming an average eight year maturity the annual payment in nominal terms would be about F$72 (US$84)/ac of sugarcane. FSC would collect the repayments for FDB as a deduction from sugarcane proceeds. Indirectly, beneficiaries would repay part of the cost of access road construction and maintenance through user charges in the form of tractor license fees and fuel taxes. For the 8,000 ac to be developed under the project, comparing loan repayments and road user charges paid by settlers to the cost of land clearing, farm development and farm access roads, the cost recovery index is 27%. Comparing loan repayments to land clearing and farm development costs alone, the cost recovery index is 53%. For a typical 50 ac farm with 15 ac of sugarcane, comparing loan repayments with incremental net farm income over the first eight years of the project gives a benefit recovery index of 34%. After subtracting incremental family labor and management costs and an allowance for uncertainty, the rent recovery index is around 100%.

5.21 For the drainage improvement part of the project, the Government proposes to reconstruct seawalls as a national expenditure which would not be recovered from beneficiaries. Farmers would repay the full cost of internal common user drains over ten years at 10% interest and the O & M cost of seawalls and drains through a drainage rate (para 5.07). Analysis indicates that a drainage rate of about F$25 (US$30)/ac in nominal terms would be needed. Since the current upper limit for drainage rates in Fiji is F$15/ac, an assurance was obtained that Drainage Boards would be empowered to levy drainage rates in the project areas sufficient to recover the full cost of common user drains over ten years at 10% interest, plus the full cost of operating and maintaining seawalls and drains. With the proposed drainage rates, the recovery index for all drainage improvement costs would be 46%, and for internal drainage alone, the cost recovery index would be 78%. The benefit recovery index for a 10-ac farm would range from 25% to 46%, depending on whether the farm is now affected by saltwater intrusion as well as impeded drainage. After subtracting incremental family labor and management costs and an allowance for uncertainty, the corresponding rent recovery index ranges from 62% to about 100%.

5.22 The analysis indicates that for both the settlement and drainage improvement areas, the proposed charges represent a reasonable contribution to project costs and would be within the beneficiaries' ability to pay. These charges would capture 34% of incremental cash income from Seaqaqa settlers and 25%-46% of incremental cash income from beneficiaries of drainage improvement. Although the rent recovery indices are largely subjective,

they do indicate that after allowances are made for the value of family labor, farm management and the uncertainty of future income streams, little or nothing in the way of project "rent" would remain with the beneficiaries during their period of loan repayment. It is therefore unlikely that farmers would be willing to participate in the project if higher rates were charged.

VI. PRODUCTION, MARKET PROSPECTS, PRICES AND FARM INCOMES

Production

6.01 Production from the Seaqaqa settlement area is presented in Annex 7. On a typical 50-ac farm with 15 ac of sugarcane, land clearing and farm development would proceed at 5 ac per year for the first three years. Replanting would be carried out on 3 ac in each succeeding year so that by year seven the rotation would stabilize at 3 ac of plant cane planted and 9 ac of ratoons cultivated each year, and the annual harvested area would be 12 ac. Cane would be grown under natural rainfall conditions and would therefore be subject to moisture stress in the dry season, particularly from June to September. However, irrigation is not a viable solution at this time. Extension agents would emphasize limiting the number of ratoons to three, and yields are assumed to average 20 ton/ac harvested for plant cane and three ratoons. Total production would reach 243 tons per farm at full development, and production from the 8,000 ac to be developed under the project would be 130,000 tons per year.

6.02 Production from the drainage improvement areas is presented in Annex 8. Two 10-ac farm models representing farms with saltwater intrusion and those with restricted internal drainage are considered. In the first type it is assumed that 3 ac are now out of production and under saltwater, 7 ac are under cane and five ratoons are taken off. Seawalls and internal drains would be repaired in year one and the farm advisor would work with the farmer to reduce the number of ratoons to three. After at least five years of leaching the farmer could begin planting cane on the reclaimed part of his farm. The total area planted would reach 10 ac in year eight and the rotation would stabilize in year twelve with 2 ac of plant cane planted and 6 ac of ratoons cultivated each year. The annual harvested area would be 8 ac per farm, average yields would increase from 20 ton/ac harvested at present to 26 ton/ac at full development, and production would increase from 120 to 208 tons. The farm model with restricted drainage would show a similar development pattern. Starting out with 2.3 ac out of cane production at present, after six years the farm would reach the same level of full development production as the saltwater intrusion model. Aggregating these results over the 26,400 ac drainage improvement area, total cane production would increase from 346,000 tons at present to 549,000 tons at full development in year 16, or an increment of some 200,000 tons annually.

Market Prospects

6.03 The incremental annual production from the entire project at full development of 330,000 tons of cane, or 41,000 tons of raw sugar, represents an increase of some 15% above current production. About 160,000 tons of the incremental cane production would be crushed at FSC's Lambasa mill. This in addition to an expected 60,000 ton increase from the 4,000 ac already developed at Seaqaqa would satisfy the mill's newly expanded capacity (para 2.18). The three mills on Viti Levu currently all have excess capacity and would have no difficulty in crushing the additional 170,000 tons of cane expected from the drainage improvement areas on that island.

6.04 It is assumed that domestic demand would grow slowly and that practically all of the additional output would be exported. Even if 400,000 tons were available for export due to the project plus other possible improvements in the sugar industry, Fiji would remain a marginal producer in the world market. The Bank's commodity analysts consider the market outlook for sugar to be favorable, and predict overall supply shortages at least through 1985. Factors responsible for this situation after 1980 include a shortage of processing capacity and the high capital cost of new capacity, currently estimated at more than US$1,000 per ton of rated sugar output capacity. Fiji has well developed export markets for her sugar. As one of the parties to the African, Pacific and Caribbean Countries Agreement of 1974, Fiji enjoys special access to the EEC market, specifically the U.K., where 55% of her export sugar is currently sold. In addition, Fiji has contracts with other buyers, mainly in Southeast Asia and the South Pacific region.

Prices

6.05 The estimated fob price per ton of Fiji export sugar for the full year 1975 is F$375 (US$446). After subtracting certified deductions for the costs of various regulatory and supervisory bodies, export duties (2%), stablilization fund levy, marketing and research costs, F$365 per ton would remain for distribution between growers and the miller. The percentage distribution is determined on an industry-wide basis and is the same for all growers throughout Fiji. The ten-year contract of 1970 (para 2.06) specified 65% for the growers and 35% for the miller. Claiming that FSC was making "excess profits," the growers in 1973 demanded that the split be changed to 80:20. A 1974 report to the Independent Chairman of the sugar industry showed that an 80:20 split would clearly undermine FSC's financial position, and recommended a 2:1 split as being equitable to both parties and reflective of the situation in other sugar producing countries today. 1/ The decision to enact a 70:30 split became effective as of the 1975 crushing season. This would provide a gross return to growers of F$255/ton of sugar or F$32/ton of cane at mill (Annex 10).

1/ United Nations Development Advisory Team (UNDAT). Report to the Independent Chairman on a Study of the Fiji Sugar Industry. Suva, December 1974, especially pp. 142-159.

6.06 With the same 70:30 split, the Bank's commodity price forecast of US$314/ton (F$264/ton) in 1985 would give an at-mill price of F$22/ton cane, which was used throughout the project life for the financial analysis. For the economic analysis, the use of a shadow exchange rate gives an economic farm gate price of F$25/ton (Annex 10). Where growers are assumed to use road transport as in the case of Seaqaqa settlers, transport costs were treated as part of farm operating costs. For farmers served by rail, FSC would pay the at-mill price at the railhead, as is the usual practice.

6.07 In the face of expected falling world sugar prices, the 70:30 split may not give FSC enough revenue to maintain an acceptable financial position. The Independent Chairman and the Government should therefore review the financial situation of both the growers and FSC annually in the light of world market price developments so that the division of proceeds permits an equitable sharing of benefits and burdens and does not undermine the future viability of the industry, which would hurt both parties. Even with a 65:35 split in 1985, the farm gate price would be more than F$20 per ton cane, which would give growers sufficient financial incentives and still give an acceptable economic rate of return on the proposed project (para 7.03).

Farm Incomes

6.08 Farm models have been prepared for a typical 50-ac settlement farm with 15 ac of sugarcane at Seaqaqa, and for two different 10-ac sugarcane farms in the drainage improvement areas. The estimated present farm incomes and those projected at full development are presented in Annexes 7 and 8 and summarized below:

Area	Farm Size	Present	Repayment Period	After Repayment
		(US$)		
Seaqaqa Settlement	50 ac with 15 ac cane	1,000	3,210-3,750	4,010
Saltwater Intrusion	10 ac	2,600	2,180-4,270	4,350
Restricted Drainage	10 ac	2,960	2,220-4,250	4,350

/a Rounded to nearest US$10.

6.09 Farmers in the Seaqaqa settlement area would realize the greatest relative and absolute income gains from the project. Although the information is limited, indications are that family incomes of subsistence farmers in the area before the settlement and that of other settlers would be below US$1,000. The farm income analysis indicates that during the first year, net family income from settlement activities would be US$560 (Annex 7). A subsistence allowance of F$400 (US$480) would therefore be needed to help tide the settler over the first year. This would be provided by FSC in cash and/or kind and added to the FDB establishment loan, as has been the practice to date in the Seaqaqa settlement. During the loan repayment period (years three

through eight), family income would be between US$3,210 and US$3,750; thereafter it would equal US$4,010, or just over US$800 per capita for a family of five. This compares to an estimated GDP per capita in 1974 of US$640 (para 2.01), which would reach US$875 by 1985 at 3% annual growth rate. The settlers would also establish subsistence food plots as time goes on and would receive a small cash income supplement from the local sale of citrus and pineapple.

6.10 Per capita incomes of US$520 to US$590 for sugarcane farmers affected by poor drainage are currently slightly below the national average but would increase to US$870 with the project at full development, or roughly equal to the expected GDP per capita in 1985. Such farmers also typically have subsistence food plots which they cultivate during the slack season. The improvements would place these farmers on a par with the bulk of Fiji's coastal sugarcane farmers whose lands are not affected by poor drainage.

6.11 The cost of the Seaqaqa settlement comes to about US$15,500 per family of five, including the residents of the proposed new township. The high cost is due largely to the heavy investments required in road and rail infrastructure to move large amounts of a heavy, bulky commodity over relatively unfavorable terrain in a short period of time. Excluding the cost of the tramline as the miller's responsibility, the main road as part of the national highway system and the township which would be paid for by the new residents, and considering only the settler/farmers as beneficiaries, the cost per family would be just over US$10,000. Further excluding the credit elements, which would be fully repaid by farmers over five years, the cost per family would be US$8,500. Family incomes in the settlement area with the project would still be below the expected national average GDP per capita in 1985 and the incomes of typical coastal cane farmers (para 6.09-6.10). The cost per family in the drainage improvement areas would be much lower -- US$3,200 for the entire investment or US$2,100 excluding seawall reconstruction, which the Government considers a national responsibility.

VII. BENEFITS AND JUSTIFICATION

7.01 The primary objective of the project is to expand sugar production for export. A secondary objective is to increase native Fijian participation in commercial agriculture. Some 3,400 sugarcane farmers and their families, or 17,000 people, plus an expected 500 township residents, would benefit directly from the project. The project would increase sugarcane production by clearing and developing 8,000 ac of largely unused land; it would provide the necessary farm machinery, vehicles and transport facilities to produce the crop and carry it to the mill; it would provide township facilities to serve the settlement community; and it would rehabilitate about 26,400 ac of coastal cane lands. The project would create some 3,500 agricultural jobs during the six-month crushing season (June-November) and would increase the demand for labor by about 800 jobs during the slack season. Sufficient

labor would be available in both the settlement and drainage improvement areas from farmers' families, seasonal local labor and seasonal migrant labor from the outer islands.

7.02 The economic analysis is presented in Annex 10. The settlement and drainage improvement parts of the project were analyzed separately since they would be carried out in two distinct areas by different organizations and would benefit different groups of people. Within each part, however, a separate or incremental analysis of the various project components was not appropriate since each part constitutes an integrated package. Assuming a 30-year evaluation period, a farm gate price for sugarcane of F$25/ton, a shadow exchange rate of US$1.05=F$1.00 and a shadow wage rate for all incremental farm labor of F$6/man-day during the crushing season and F$3/man-day during the slack season, the economic rates of return would be 20% for the Seaqaqa settlement and 20% for the drainage improvements. The economic rate of return for all project investments combined would also be 20%.

7.03 In evaluating the settlement, the costs of the tramline extension, the township development and half of the main road improvements have been excluded, since they would generate separate benefits other than those from increased sugarcane production, as discussed in Annex 10. If the full costs of these items are included and benefits remain unchanged, the rate of return would still be 12%. The rates of return show modest sensitivity to cost overruns and the assumptions made concerning the level and timing of agricultural benefits. Even under the most adverse cases tested, namely a 20% increase in construction costs and a 25% decrease in benefits, the rate of return on each part of the project would still exceed 13%.

7.04 At full agricultural development, annual sugar export earnings due to the project would amount to US$13.1 million at the forecast world market price fob Lautoka/Lambasa (in terms of 1975 constant prices) of US$314/ton. After deducting the incremental cost of imported fertilizers, the net foreign exchange earnings would be about US$12.0 million per year.

VIII. AGREEMENTS REACHED AND RECOMMENDATION

8.01 During negotiations, agreement with the Government was reached on the following principal points:

(a) the Government would continue to employ a person, with qualifications, experience, powers and responsibilities acceptable to the Bank, as Seaqaqa Project Manager (para 5.02);

(b) PWD would employ a road engineer, with qualifications, experience powers and responsibilities acceptable to the Bank, to head the construction unit for Seaqaqa settlement roads as his primary responsibility (para 5.05);

(c) regional offices of DID would be set up and suitably staffed; and that qualified and experienced engineers, with powers and responsibilities acceptable to the Bank, would be appointed as Divisional Engineers to head these offices, before any contract work on the drainage improvement part of the project is carried out (para 5.10);

(d) FSC, with seconded staff from the Department of Agriculture as required, would provide an adequate number of farm advisors for the Seaqaqa settlement area (para 5.15); and

(e) Drainage Boards would be empowered to levy drainage rates in the drainage improvement areas sufficient to recover from project beneficiaries the full cost of common user drains over ten years at 10% interest, plus the full cost of operating and maintaining seawalls and common user drains (para 5.21).

8.02 The conclusion of a subsidiary loan agreement between the Government and FDB, satisfactory to the Bank, would be a condition of effectiveness of the proposed loan (para 4.17).

8.03 The proposed project would be suitable for a Bank loan of US$12.0 million, with a 20-year maturity including a grace period of five years. The borrower would be Fiji.

FIJI

SUGAR DEVELOPMENT PROJECT

Climatic Data

	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Rainfall (in)														
Lambasa	45	12.99	14.41	14.41	8.39	4.80	2.09	1.88	1.81	2.80	3.58	5.98	10.12	83.3
Lautoka	34	8.94	14.06	11.89	6.18	4.41	2.09	2.04	3.23	2.20	3.23	4.25	7.20	69.7
Penang	55	11.61	14.80	13.39	9.68	5.20	2.72	2.01	2.99	2.52	3.39	5.20	9.09	82.6
Suva	47	11.26	12.05	14.76	12.80	10.04	6.50	5.20	8.07	7.56	8.50	9.88	11.97	118.6
Rainfall Probability at Seaqaqa Forest Station (in)	13													
90%		8.13	10.69	9.17	5.55	0.68	0.40	0.53	0.22	1.51	2.58	3.55	7.16	
60%		14.66	18.01	19.44	11.06	3.72	2.33	1.55	2.17	3.30	5.18	8.02	13.40	
50%		17.32	21.00	21.59	11.24	3.72	3.60	1.55	2.48	3.37	5.83	9.54	15.19	
Percentage of Droughts at Seaqaqa Forest Station of 26 to 31 days (%)	13	--	--	--	--	50.9	38.2	43.9	45.2	15.4	7.4	--	--	
Mean Temperature (°F)														
Lambasa		79.9	80.0	79.7	78.9	77.2	75.8	74.6	75.2	76.4	77.6	78.4	79.4	77.8
Nandi		80.7	80.6	80.1	79.2	76.9	75.5	74.1	74.7	76.1	77.3	78.5	79.8	77.7
Relative Humidity (%)														
Lambasa		78	81	82	82	79	79	76	71	69	67	69	71	75
Nandi		75	78	80	80	77	79	76	71	69	66	67	69	74
Sunshine (Average Hours)														
Lambasa		149	148	169	168	195	176	205	208	187	177	179	185	2146
Nandi		205	178	184	194	208	208	216	238	211	224	221	220	2507
Suva		179	154	155	157	156	136	144	154	137	160	169	197	1898

Lambasa, Lautoka, Penang and Nandi are representative of the Drainage Improvement areas. In all these areas, sugarcane has been grown satisfactorily for many years. Records of rainfall at the Seaqaqa agricultural research station are available for only 8 years. Though the period is too short for sure comparison, the seasonal pattern is the same as at Lambasa, 25 mi away on the coast, with a higher mean annual rainfall of 88.8 in. The rainfall probabilities shown for Seaqaqa Forest Station, higher and wetter than the settlement area, are based on 13 years' recording and are indicative only.

ANNEX 1
Table 1

FIJI

SUGAR DEVELOPMENT PROJECT

Seaqaqa Settlement

Agricultural Practices and Production

1. The proposed calendar of farm operations is shown in Chart 15157(2R)). It provides for full tractor cultivation during the dry season, followed by planting and harvest of the plant cane crop after 13 to 14 months. Replanting would take place after three ratoons, followed by a year of fallow or under legume, unless the price/yield/cost ratios indicate a change. Harvesting would be done in the traditional manner by gangs of cane cutters (para 3). Some operations such as planting in mechanically prepared furrows, supplementary weeding and spreading of fertilizer and cane trash (for ratoons) are suitable for family labor and would be carried out by hand.

2. Cane would be grown under natural rainfall conditions and is therefore subject to moisture stress in the dry season, particularly from June to September. However, irrigation is not a practical solution. Recommended fertilizer applications for plant cane are 7 cwt/ac sulphate of ammonia (21-0-0), 5 cwt/ac superphosphate (0-19-0) and 1 cwt/ac muriate of potash (0-0-58). With these applications and reasonable management, yields between 20 and 25 ton/ac for Ragnar and Mali, the two varieties being used so far, have been obtained. However, in the few cases where farmers have applied smaller amounts, yields have been much lower. For ratoons, 6 cwt/ac sulphate of ammonia and 2 cwt/ac superphosphate are recommended. For purposes of project analysis, yields have been taken as 24 ton/ac for plant cane, 22 ton/ac for first ratoon, 19 ton/ac for second ratoon and 16 ton/ac for third ratoon, or an average of 20 ton/ac harvested at full project development. Assuming an average five year rotation in which 12 ac are harvested on each 15 ac farm each year, total annual production from the 12,000 ac settlement area at full project development would be 194,000 tons, and incremental production from the 8,000 ac to be developed under the project would be 130,000 tons (Annex 7).

3. As is normal practice in Fiji, harvesting would be carried out by gangs working to a schedule laid down by FSC. The harvesting season varies from 24 to 30 weeks, roughly from May through October, sometimes extending into December. Gangs are composed mostly of farmers and members of their families, supplemented by casual labor from the neighborhood or sometimes from other islands. National statistics show that on average, 60% of gang members are drawn from farmers and their families and 40% from outside. The size of gangs varies, although FSC aims at a gang size of about 20, with 15 men working each day, seven days a week, allowing for time off. Each gang cuts and loads 4,000 to 5,000 tons a year in about 150 working

days, or about 30 tons a day. Cane is loaded onto rail trucks, each carrying about 3 tons, requiring 10 trucks a day per gang.

Project Components

4. Land Clearing and Farm Development. As of the end of 1975, some 600 farm blocks out of the planned 800 had been surveyed and allocated to settlers, and 400 of these had been occupied and partly developed to sugarcane. Survey and subdivision of the remaining 200 blocks would be done by NLTB surveyors in cooperation with a field officer from the Ministry of Agriculture, Fisheries and Forests (MAFF) specialized in land classification. A total of 8,000 ac would be cleared under the project - 3,000 ac on the 200 newly subdivided farms and 5,000 ac remaining to be cleared on the 600 farms already allocated. In addition, the project would finance farm development up to first harvest for the 400 settlers who had not established farms by the end of the 1975 planting season (200 newly subdivided plus 200 previously subdivided but not developed).

5. Land clearing is carried out mechanically using bulldozers. It is estimated that 14% of the area remaining to be cleared is under scrub, 43% under medium forest and 43% under heavy forest. After felling, the timber, which does not have commercial value, is windrowed and burned. The area is single ripped and any stumps and roots removed. Farm development consists of double plowing, double harrowing and furrowing using wheeled tractors, as well as provision of seed cane, fertilizers and other inputs. Settlers are also provided with galvanized iron sheet for building their own houses. The program for land clearing and farm development is as follows:

Item	Pre-project	Year				Total Project	Total Settlement
		1976	1977	1978	1979		
	ac						
Survey and Subdivision	30,000	10,000	-	-	-	10,000	40,000
Land clearing-light	2,000	400	300	200	200	1,100	3,100
-medium	1,200	800	850	900	900	3,450	4,650
-heavy	800	800	850	900	900	3,450	4,250
Total	4,000	2,000	2,000	2,000	2,000	8,000	12,000
Farm development	4,000	2,000	2,000	2,000	2,000	8,000	12,000

6. Tramline Extension. The sugar tramline serving the Lambasa mill currently extends as far as Wailevu (Map 11852). Part of the project would be to extend the tramline westward a distance of about 6.5 mi to the foot of the Seaqaqa plateau at Tambia. Earthworks for the extension are being

carried out by contract and comprise the formation of a subgrade using cut and fill. The roadway would be 16 ft wide. Embankments would be of compacted fill with side slopes of 1.5:1. Side slopes in cut sections would vary from 1:4 (rock only) to 1:1 (clay only). The works also include construction of side drains, culverts of various sizes with inlet and outlet structures, minor realignment of access tracks and roadways and the relocation of a few minor buildings.

7. Roads. Road construction would be carried out by a Public Works Department (PWD) road construction unit stationed at Seaqaqa under force account with equipment to be procured under the project. The unit would be headed by a qualified and experienced road engineer under PWD's Divisional Engineer, Northern, and would be staffed as indicated in Chart 15155(3R).

8. The existing main coastal road from Tambia along the coast and up the Seaqaqa plateau to Korovuli could not accommodate the heavy volume of cane traffic which the project would generate. The project would therefore include construction of a new section of main road from the new tramline terminus at Tambia to Korovuli following the best route in terms of distance and terrain (Map 11852). The new road would cover 7.3 mi and be built to PWD main road standards (Table 1). It would link up at Korovuli with the existing main road through the project area to Vunimako, and would eventually form a section of the transinsular road across Vanua Levu from Savusavu to Lambasa, now under construction. One major bridge on the new road would be constructed at the same time as the road works (Chart 15164). Traffic density by 1978 would exceed 500 vehicles per day during the crushing season and the new road, as well as 1.6 mi of the existing road from Korovuli to Seaqaqa township, would be tarmac 1/ surfaced. The remaining 8.1 mi of main road through the settlement area from Seaqaqa township to Vunimako would be upgraded to gravel surfaced main road standard.

9. About 125 mi of access roads would be required to serve each of the 800 farms in the settlement area. Of this, 8 mi have been completed by PWD to country road standards and the remaining 117 mi would be constructed to the same standards under the project (Table 1). Major earthworks would be carried out by motor scrapers and bulldozers. Fill would be compacted in 6-in layers using sheepsfoot and grid rollers towed by wheeled tractors. After grading, the gravel running course would be spread and compacted. PWD estimates that earth moving would amount to 17,000 yd^3 of compacted fill (21,250 yd^3 excavated from bank) per mi. In the absence of survey data, project cost estimates assume one box culvert (5 ft x 5 ft) and 3 pipe culverts per mi.

10. A maintenance sub-depot would be established at Seaqaqa township consisting of offices and a workshop with vehicle pits and stores. During the construction period, the depot would serve as a construction camp as

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1/ Penetration macadam.

well as a base for maintaining completed roads. Afterwards a maintenance unit consisting of one road foreman, four operators, ten drivers and 20 laborers, under a part-time road supervisor, would maintain all project roads using two graders, one loader, one bulldozer, five dump trucks and one flatbed truck to be left at the sub-depot. The remainder of the construction equipment with a residual value estimated at US$650,000 would be used by PWD to complete the transinsular road from Lambasa to Savusavu now under construction (Map 11851), or for other high priority road construction work under DPVII. The additional equipment would replace similar equipment which is expected to wear out over the next five years and is not expected to significantly enhance PWD's long term force account construction capability. The annual operating cost (including salaries and wages) of the maintenance unit is estimated to be F$110,000 (US$130,000) or about F$820 (US$975)/mi/year.

11. Tractors and Cane Transport. Tractors at Seaqaqa would be used for two primary purposes: transport of cane from the field to pickup points on the main road, and field operations. It is estimated that 75 farm tractors (65 hp) would be required at Seaqaqa, or one for just over ten farms. Fifty of these would be for harvesting and in-field transport while 25 would be for field operations which coincide with the harvest season. All tractors would be fully employed during the crushing season. Twenty-five tractors had been purchased for use in the settlement area by the end of 1975, leaving 50 for financing under the project.

12. Cane transport vehicles would be used to collect loaded cane trucks at pickup points along the main road and deliver them to the Tambia railhead. It is estimated that 17 cane transport vehicles (12-ton) would be needed to carry the 200,000 tons of cane an average distance of 12 mi to the railhead, working two, eight-hour shifts a day, six days a week over a 24-week crushing season. Three vehicles had been purchased by the end of 1975, leaving 14 to be financed under the project.

13. To ensure roughly equal participation in all aspects of the project between Fijians and Indians, the Native Land Development Corporation (NLDC) would own and operate up to half the tractors and transport vehicles, and would train Fijians in their use. NLDC would also operate a garage, service station and workshop to maintain and repair the tractors and cane transport vehicles in the Seaqaqa area.

14. The Fiji Development Bank (FDB) would provide loans to individuals or to NLDC to buy their own tractors or cane transport vehicles from local suppliers. To be eligible for financing under the project, all such purchases would have to be certified by the Seaqaqa Project Manager as being required for the project.

15. Township Development. All Seaqaqa settlers would live in individual houses built on their farms. However, a centrally located township would be built to provide various economic and social services such as banks, schools, a market area, shops, health facilities, churches, temples, cemeteries, etc. It is expected that the township itself would initially

comprise some 100 families, or about 500 people, of whom about one-third would be directly associated with the project, in addition to the sugarcane farmer-settlers. NLDC is responsible for developing the new township. The Corporation would operate as a commercial developer and would recover its investment costs from township residents. The township area has been set aside as a separate subdivision and has been declared a Town Planning Area by the Minister for Urban Development. The Director of Town and Country Planning has also indicated formal provisional approval of a town plan.

16. The township development part of the project would consist of the installation of basic sites and services comprising roads, community areas, water supply, stormwater drainage, electricity supply and a workshop for tractors and cane transport vehicles. Township roads totaling about 1.2 mi would be constructed in commercial, residential and industrial areas according to PWD country town standards. Bulk excavation would be provided for shaping of ground in the industrial area, school grounds and playing fields, bus stations, market, etc. Water would be pumped from the Ndreketi river and storage, filter, treatment plant and reticulation would be provided. Soil tests have shown that a system of septic tanks would be adequate for the township, thereby eliminating the need, at least during the development phase, for a sewerage system and treatment plant. Electricity would be supplied from a 100 kVA generator and the Fiji Electricity Authority would install the distribution system.

Cost and Implementation

17. The total cost of the Seaqaqa settlement including physical contingencies and costs due to expected price increases is estimated to be US$17.4 million, of which US$8.4 million would be foreign exchange (Annex 4). The works would be carried out over four years beginning January 1976 with the exception of the tramline extension which has already begun and is scheduled for completion by August 1976 (Chart 15164).

18. The cost of the entire settlement comes to about US$15,500 per family of five, including the residents of the proposed new Seaqaqa township. The high cost is due largely to the heavy investments required in road and rail infrastructure to move large amounts of a heavy, bulky commodity over relatively unfavorable terrain in a short period of time. Excluding the cost of the tramline as the miller's responsibility, the main road as part of the national highway system, and the township which would be paid for by the new residents, and considering only the settler/farmers as beneficiaries, the cost per family would be just over US$10,000. Further excluding the credit elements, which would be fully repaid by farmers over five years, the cost per family would be US$8,500.

19. For project roads, unit base costs including engineering and supervision are estimated to be about US$100,000/mi for construction of main roads, US$70,000/mi for tarmac surfacing and US$18,000/mi for upgrading existing gravel surface main roads. Construction of one major bridge would cost an estimated US$380,000. Newly constructed farm access roads would cost about US$23,000/mi.

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SUGAR DEVELOPMENT PROJECT

Road Design Standards

	Main Roads	Country Roads
Design speed (mph)	50	20
Pavement width (ft)	24	12
Shoulder width (ft)	5	5
Formation width (ft)	38	24
Minimum horizontal radius (ft)	150	108
Stopping sight distance (ft)	240	240
Maximum gradient (%)	10	12.5
Surface	compacted gravel or tarmac	compacted gravel

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SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Background

1. The areas affected by poor drainage are scattered along the northern and western coasts of Viti Levu and Vanua Levu (Map 11851) and fall into two distinct types. The first lies just inland from the coast and consists of about 11,000 ac of former mangrove swamp reclaimed at the end of the century, where coastal bunds and outfall structures have fallen into disrepair and the area is affected by saltwater intrusion and flooding. About 3,400 ac of this land has gone completely out of production and on the remaining 7,600 ac, average yields have declined about 8-10 ton/ac. The second category is further inland and covers about 17,400 ac of land above sea level, where the internal drainage system has deteriorated due to lack of maintenance and siltation from runoff upstream in the catchment area. Of the total affected area, about 2,600 ac have gone out of sugarcane production and are used for rice or left fallow as pasture. On the remainder, average yields are down about 5 ton/ac.

2. Works would be carried out to rehabilitate and improve drainage on the entire 28,400 ac. About 2,000 ac around Lambasa were rehabilitated by the Drainage and Irrigation Division (DID) during 1975 and the remaining 26,400 ac would be included in the project. Most of the works would be on Viti Levu where drainage would be improved on 20,100 ac or 20% of the total sugarcane land in the Lautoka, Rarawai and Penang mill areas. This is made up of four main areas and a number of smaller ones extending from Raki Raki in the north to Singatoka in the southwest of the island, a distance of about 120 mi. On Vanua Levu the proposed improvements would be concentrated around Lambasa and would include about 6,300 ac (excluding the 2,000 ac rehabilitated by DID in 1975) or 10% of the total cane area in the Lambasa mill area (Table 1 and Map 11851).

Agricultural Practices and Production

3. Unlike the Seaqaqa settlement area, farmers are already growing cane in the drainage improvement areas and, apart from drainage improvement, no major change in agricultural practices would be attempted. Aside from minor freehold and Crown land areas, cane farmers, both Indian and Fijian, hold agricultural leases from the Native Land Trust Board (NLTB). Leases are normally for ten years, twice renewable, and most leases are for farms between 10 and 15 ac. Farmers receive cane contracts from the Fiji Sugar Corporation (FSC) which in the past have generally been for 10 ac, but which

have recently been increased to 15 ac, where land is available, due to the improved world market situation for sugar.

4. Traditionally, land is prepared and planted in February and March, during the wet season, and cane is harvested in May through November of the following year. Multiple ratooning is carried out with up to five or six ratoons being taken off. In the improved drainage areas, extension workers would emphasize reducing the number of ratoons to three. The land is cultivated by plows, scarifiers and harrows drawn by tractors, horses or bullocks. Nearly all Indian growers own draft animals and those who own tractors do plowing on a custom hire basis for others as well as on their own farms. Most cultivation is still done by bullocks, although tractors are becoming more common.

5. The three main cane varieties currently planted, Ragnar, Waya and Mali, have advantages of disease resistance, high sucrose content and good milling qualities; they are not, however, high yielding. Seed cane areas are inspected by FSC inspectors and effective roguing has almost eliminated the two main diseases, downy mildew and Fiji disease. Fertilizers are supplied through FSC which has an efficient distribution service. Timing and amounts of application vary, although about 5 cwt/ac of a 3:1 sulphate of ammonia and superphosphate mixture appears most common. Weeds in the rows are generally hoed by hand.

6. Harvest time is from May to November and about 80% of the cane is cut unburnt, although the percentage of burnt cane has been increasing in recent years. Cane cutting is done by gangs composed of farmers and casual laborers. The amount of work involved for the farmer is roughly equivalent to what he would have to do if he cut the cane on his own farm single-handed. The gang, which may include Fijians as well as Indians, elects a sirdar or foreman who directs operations under the general supervision of the FSC field officers. This cooperative effort saves time and also has the social value of mixing the two communities. After the cane is cut it is loaded on 3-ton rail trucks which are hauled into the fields on portable lines by bullocks. The loaded trucks are then hauled to the main tramway line for conveyance to the mill by FSC locomotives. Some of the cane grown in remote areas is delivered to the mill by road. After harvest the remaining cane trash is burned and the cane is molded up by moldboard plow and bullocks.

7. UNDAT 1/ has estimated that, based on considerations of soil types and rainfall level and distribution, cane yields should average 33 ton/ac on flat land (0-3% slope). Since the drainage improvement areas are flat and have favorable soils for growing sugarcane, average yields in excess of

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1/ United Nations Development Advisory Team (UNDAT). "Report to the Independent Chairman on a Study of the Fiji Sugar Industry," 1974, pp. 10-11.

30 ton/ac should be obtained. However, due to drainage problems and waterlogging as well as poor management, particularly on Fijian farms, average yield is only about 18 ton/ac harvested, with production of about 350,000 tons over the 26,400 ac to be improved under the project. Without the project the situation would undoubtedly deteriorate further. With the project it is assumed that the average yield would increase to 26 ton/ac harvested, or about 20% below the potential yield on flat land. At the same time the harvested area would increase from 17,000 ac to 21,000 ac. Production from improved drainage and farm management would therefore increase to about 550,000 tons, or an increment of some 200,000 tons of cane per year (Annex 8).

Project Works

8. Photogrammetric Mapping. Existing mapping of the drainage areas on Vanua Levu, carried out by consultants for FSC, is adequate for planning and preliminary designs. Field surveys would, however, be necessary for final designs. The drainage areas on Viti Levu have not been mapped to the required detail, and some 50,000 ac would be mapped under the project by the Lands Department at a scale of 1:10,000.

9. Design and Construction. Design would be done by DID's central design office and works would be constructed by local contractors supervised by the Division Engineers and their works supervisors in the Northern and Western divisions. To facilitate detailed field surveys, design and construction supervision, the project would provide offices for the Division Engineers and their staffs at Lambasa and Lautoka and procurement of eight, four-wheel drive vehicles for their use.

10. Seawall Reconstruction. Reclaimed areas are protected by 22.7 mi of seawalls, of which 2.4 mi are on Vanua Levu and 20.3 mi on Viti Levu. The walls, which are in fair to very poor condition, were constructed in mangrove areas from fill obtained from borrow drains immediately behind them. Most of the existing embankments have suffered considerable damage from burrowing shellfish. The shellfish (Thalassina anamola) feed on organic matter in the mangrove mud, where they burrow to depths of 3 ft. They do not, however, burrow in compacted clays or earth fill containing little or no organic matter.

11. Because of the shellfish problem, new embankments would be built to minimize damage from burrowing and reduce the need for maintenance. A cutoff trench would first be dug on the seaward face of the existing wall. The trench would then be filled and the new wall constructed outside the existing embankment with compacted, non-organic earth fill from outside the vicinity of the walls. The existing embankment would be partly incorporated as the landward toe of the new one. Excess material would be bulldozed into the original borrow drains, which serve no purpose. The new seawalls would have side slopes of 3:1 and a top width of 12 ft. A 10 ft wide road, surfaced with 6 in of compacted gravel, would be built on top of the walls.

The seawalls would have a 3 ft freeboard above high spring tide level. The normal tidal range is about 4 ft.

12. Tidal outfall structures would consist of Armco culverts through the seawalls, equipped with vertically hung, lock-type, timber tidal gates in the inside headwalls. Sufficient discharge structures would be provided in each drainage basin to evacuate the runoff from 10 in of rain in three days. This is equivalent to the one-in-five-year probable 24-hour rainfall on the catchments and would be adequate to prevent damage to the sugarcane crop.

13. Internal Drainage Improvement. The project would involve cleaning and re-excavating about 430 mi of main and secondary drains and clearing outfalls to enable on-farm drains to discharge adequately. Where necessary, parts of the drainage system would be realigned. Main drains to tidal outfalls exist in most cases but secondary drains in the 3,400 ac out of production are no longer effective. It would be necessary to excavate the secondary drains in these areas. A typical secondary drain would be 4.5 ft deep with a 3 ft bottom width and 1.5:1 side slopes.

14. On-farm drains totalling about 910 mi in length would be excavated and maintained by the farmers. The work would involve about 25 man-days for construction and five man-days maintenance annually for the average 10-ac farm.

Cost and Implementation

15. The cost of drainage improvement including physical contingencies and costs due to expected price increases is estimated to be US$8.3 million, of which US$3.6 million would be foreign exchange (Annex 4). The total cost comes to US$3,200 per family of five and US$2,100 per family excluding the seawall rehabilitation, which the Government considers a national responsibility. The works are scheduled for execution over five years beginning February 1976 (Chart 15164). Unit construction costs are summarized in Table 2.

ANNEX 3
Table 1

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SUGAR DEVELOPMENT PROJECT

Drainage Improvement Areas

Mill Area	In Production with reduced yields	Out of cane Production	Total Area Affected	Average Farm Size
	ac			
Lautoka				
Lautoka	3,190	780	3,970	9.7
Nandi	2,300	330	2,630	10.2
Singatoka	2,730	400	3,130	10.0
Sub-total	8,220	1,510	9,730	10.0
Rarawai				
Mba	4,960	200	5,160	10.1
Tavua	1,680	1,210	2,890	11.1
Sub-total	6,640	1,410	8,050	10.4
Penang	2,270	60	2,330	11.3
Lambasa	5,230	3,060	8,290 1/	11.1
TOTAL	22,360	6,040 2/	28,400 1/	10.4

1/ Includes 2,000 ac improved by DID in 1975 outside the project.

2/ Includes 3,400 ac of saltwater intrusion and 2,600 ac with poor internal drainage.

ANNEX 3
Table 2

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SUGAR DEVELOPMENT PROJECT

Drainage Improvement Cost Summary 1/

	Quantity	Unit	Rate (US$)	Total Cost 1/ (US$ '000)	Cost/ac 2/ (US$)
SEAWALL CONSTRUCTION					
Seawalls	22.7	mi	40,750	925	85
Tidal Gates					
3-Barrel Culverts	5	No	57,000	285	
Single-Barrel Culverts	25	"	18,800	470	
Sub-total				755	70
Total - Seawall Construction				1,680	
INTERNAL DRAINAGE					
Excavation					
Reclamation Area 3/	11,000	ac	72	790	70
Drainage Improvement Area 4/	15,400	"	42	650	40
Sub-total				1,440	
Structures					
Field access structures 5/	90	No	3,700	335	12
Drops, road crossings, etc.	90	"	10,400	935	35
Sub-total				1,270	
Total - Internal Drainage				2,710	

1/ Source: Sample area prepared by DID and mission estimates.
2/ Seawall construction only protects the 11,000 ac reclamation area. Costs rounded to nearest US$10.
3/ Cost based on 80 yd^3/ac @ US$0.90/$yd^3$.
4/ Cost based on 65 yd^3/ac @ US$0.65/$yd^3$.
5/ One field access structure to 300 ac.

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SUGAR DEVELOPMENT PROJECT

Cost Estimate

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange
	F$ '000			US$ '000			%
1. SEAQAQA SETTLEMENT							
A. Land Clearing (8,000 ac)	860	550	1,410	1,010	640	1,650	39
B. Farm Development (400 farms)	210	140	350	250	160	410	39
C. Wailevu-Tambia Tramline (6.5 mi)							
(a) Earthworks	320	310	630	370	370	740	50
(b) Track, Bridges & Collection Points	330	-	330	390	-	390	-
Sub-total	650	310	960	760	370	1,130	33
D. Roads							
(a) Construction Equipment	300	1,200	1,500	350	1,410	1,760	80
(b) Access Road Construction (117 mi)	820	730	1,550	960	850	1,810	47
(c) Main Road Construction 1/	1,270	1,340	2,610	1,490	1,570	3,060	51
(d) Maintenance Depot	30	50	80	30	60	90	67
Sub-total	2,420	3,320	5,740	2,830	3,890	6,720	58
E. Cane Transport Vehicles	200	580	780	230	680	910	75
F. Tractors, Trailers & Implements	130	360	490	150	420	570	74
G. Township Development							
(a) Roads	260	200	460	300	240	540	44
(b) Water Supply & Sewerage	100	70	170	120	80	200	40
(c) Electricity Supply	20	50	70	20	60	80	75
(d) Community Facilities	60	10	70	70	10	80	12
(e) Workshop	20	40	60	30	40	70	57
Sub-total	460	370	830	540	430	970	44
H. Engineering, Supervision & Adm.	970	-	970	1,130	-	1,130	-
Sub-total A to H	5,900	5,630	11,530	6,900	6,590	13,490	49
I. Contingencies							
(a) Physical 10%	590	560	1,150	690	660	1,350	49
(b) Expected Price Increases 2/	1,460	1,140	2,600	1,710	1,330	3,040	44
Sub-total I	2,050	1,700	3,750	2,400	1,990	4,390	45
Total Seaqaqa Settlement	7,950	7,330	15,280	9,300	8,580	17,880	48
2. DRAINAGE IMPROVEMENT							
A. Photogrammetric Mapping	90	-	90	100	-	100	-
B. Offices	40	30	70	50	30	80	37
C. Vehicles	10	40	50	10	50	60	83
D. Seawall Reconstruction	710	730	1,440	830	850	1,680	51
E. Internal Drainage	1,280	1,030	2,310	1,500	1,210	2,710	45
F. Engineering, Supervision & Adm.	380	-	380	450	-	450	-
Sub-total A to F	2,510	1,830	4,340	2,940	2,140	5,080	42
G. Contingencies							
(a) Physical 20%	500	360	860	580	430	1,010	43
(b) Expected Price Increase 2/	1,010	730	1,740	1,180	850	2,030	42
Sub-total G	1,510	1,090	2,600	1,760	1,280	3,040	42
Total Drainage Improvement	4,020	2,920	6,940	4,700	3,420	8,120	44
TOTAL PROJECT COST	11,970	10,250	22,220	14,000	12,000	26,000	46

1/ Main road construction would consist of 7.3 mi of new construction and 9.7 mi of upgrading. Of the total 17 mi, 8.9 mi would be tarmac surfaced.

2/ Expected price increases are based on the following annual inflation rates:

	1976	1977-79	1980
Civil Works	14%	12%	10%
Equipment and Services	10%	8%	7%

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SUGAR DEVELOPMENT PROJECT

Expected Price Increases

	1976	1977	1978	1979	1980	Total
Seaqaqa Settlement						
1. Civil Works (US$'000)	3,400	3,355	2,255	1,700	-	10,710
Annual Inflation Rate (%)	14	12	12	12	-	
Expected Price Increases,(US$'000)	240	700	800	890	-	2,630
2. Equipment and Services (US$'000)	2,665	785	405	275	-	4,130
Annual Inflation Rate (%)	10	8	8	8	-	
Expected Price Increases (US$'000)	130	110	90	80	-	410
3. Total Before Price Increases (US$'000)	6,065	4,140	2,660	1,975	-	14,840
Total Expected Price Increases (US$'000)	370	810	890	970	-	3,040
Total Seaqaqa Settlement (US$'000)	6,435	4,950	3,550	2,945		17,880
Drainage Improvement						
1. Civil Works (US$'000)	1,380	1,180	1,195	1,325	870	5,930
Annual Inflation Rate (%)	14	12	12	12	10	
Expected Price Increases (US$'000)	95	240	415	680	590	2,020
2. Equipment and Services (US$'000)	100	60	-	-	-	160
Annual Inflation Rate (%)	10	8	-	-	-	
Expected Price Increases	5	5	-	-	-	10
3. Total Before Price Increases (US$'000)	1,480	1,220	1,195	1,325	870	6,090
Total Expected Price Increases (US$'000)	100	245	415	680	590	2,030
Total Drainage Improvement (US$'000)	1,580	1,465	1,610	2,005	1,460	8,120
Total Expected Price Increases (US$'000)	470	1,055	1,305	1,650	590	5,070

ANNEX 4
Table 2

FIJI

SUGAR DEVELOPMENT PROJECT

Equipment List

	Item	Quantity	Unit Cost	Total Cost
			------US$------	
A.	Road Construction Plant 1/			
	Motor Scraper 475 hp	2	187,000	374,000
	Bulldozer 200 hp	2	114,000	228,000
	Bulldozer 140 hp	2	82,000	164,000
	Bulldozer 75 hp	2	45,000	90,000
	Grader 125 hp	2	64,000	128,000
	Loader 100 hp	2	48,500	97,000
	Dump truck 6 yd^3	10	13,500	135,000
	Flatbed truck with hoist, 7 ton	2	13,000	26,000
	Mobile crusher and screens	1	128,000	128,000
	Sheepsfoot roller	2	16,000	32,000
	Grid roller	2	17,000	34,000
	4 wheel drive tractor	2	14,500	29,000
	Trailer, 3 ton	1	2,000	2,000
	Compressor, 250 cfm with tools	3	13,500	41,000
	Pump, 3 in	2	2,000	4,000
	Pump, sump	2	1,500	3,000
	Fuel bowser 2,000 gal	1	12,000	12,000
	Mobile Workshop	1	44,000	44,000
	Concrete mixer 7/5	2	2,500	5,000
	Bar Cutter and Bender	2	2,500	5,000
	Vibrator	4	1,250	5,000
	Pickup	2	7,000	14,000
	Spares 10%			160,000
	Sub-total			1,760,000
B.	Cane transporters, 13.5 ton 2/	13	70,000	910,000
C.	Tractors, Trailers and Implements 2/			
	Tractors, 65 hp	50	8,300	415,000
	Single Truck Trailers	25	3,360	84,000
	3-disc Plow	40	850	34,000
	Disc Harrow	40	550	22,000
	9-tine tiller	10	500	5,000
	Rotovator 60 in	10	2,000	20,000
	Sub-total			580,000
	Equipment for Seaqaqa Township			
D.	Diesel Generators, 100 kVA	1	30,000	30,000
	Workshop Equipment, lump sum			40,000
	Sub-total			70,000
E.	Vehicles for DID			
	Station Wagon 4 x 4	8	7,500	60,000
	TOTAL			3,380,000

1/ After the completion of road construction this equipment will be used by PWD for similar construction work elsewhere in Fiji with the exception of the following plant to be left at the Seaqaqa sub-depot for road maintenance: 2 graders, 1-75 hp bulldozer, 1 loader, 5 dump trucks and 1 flatbed truck.

2/ Additional to 25 tractors and three cane transporters which have already been purchased for use at Seaqaqa.

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SUGAR DEVELOPMENT PROJECT

Estimated Schedule of Expenditures 1/

	Total Cost	FY 76 2/	FY 77	FY 78	FY 79	FY 80	FY 81
				(US$ '000)			
Seaqaqa Settlement							
Land Clearing	2,200	260	560	560	580	260	-
Farm Development	460	120	230	110	-	-	-
Wailevu-Tambia Tramline	1,260	920	340	-	-	-	-
Roads	8,140	1,720	2,890	1,700	1,220	610	-
Cane Transport	900	200	300	200	200	-	-
Tractors, Trailers and Implements	640	120	260	260	-	-	-
Township Development	1,240	-	620	620	-	-	-
Sub-total	14,840	3,340	5,200	3,450	1,980	870	-
Drainage Improvement							
Offices and Vehicles	180	-	180	-	-	-	-
Seawall Reconstruction	2,260	370	870	290	290	440	-
Internal Drainage	3,650	200	530	770	1,020	860	270
Sub-total	6,090	570	1,580	1,060	1,310	1,300	270
Total Before Price Increases	20,930	3,910	6,780	4,510	3,290	2,170	270
Expected Price Increases	5,070	190	860	1,170	1,370	1,280	200
Total Project Cost	26,000	4,100	7,640	5,680	4,660	3,450	470

1/ Expenditure categories include supervision and administration costs for civil works and physical contingencies.

2/ IBRD Fiscal Years.

ANNEX 6
Table 1

ANNEX 6
Table 2

FIJI

SUGAR DEVELOPMENT PROJECT

Estimated Schedule of Disbursements

IBRD Fiscal Year and Semester	Accumulated Disbursements US$ '000 Equivalent
Fiscal Year 1977	
1st	1,300
2nd	2,900
Fiscal Year 1978	
1st	6,000
2nd	7,100
Fiscal Year 1979	
1st	8,700
2nd	9,700
Fiscal Year 1980	
1st	10,400
2nd	11,200
Fiscal Year 1981	
1st	11,500
2nd	11,800
Fiscal Year 1982	
1st	12,000

Closing Date: December 31, 1981

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SUGAR DEVELOPMENT PROJECT

Proposed Allocation of Loan Proceeds

Category 1/	Costs Total	Costs Foreign	Proposed Loan
	(US$ million)		
I. Civil Works			
A. Through Fiji Development Bank			
1. Seaqaqa Settlement			
(a) Land Clearing	1.7	0.6	
(b) Farm Development	0.1	-	
(c) Tramline Extension	1.0	0.4	
(d) Township Development	0.9	0.3	
(e) Expected Price Increases 2/	1.1	0.4	
2. Drainage Improvement			
(a) Internal Drainage	2.7	1.2	
(b) Expected Price Increases 2/	1.3	0.5	
B. By Government Directly			
1. Seaqaqa Settlement			
(a) Roads	5.0	2.4	
(b) Expected Price Increases 2/	1.5	0.7	
2. Drainage Improvement			
(a) Seawall Reconstruction	1.7	0.9	
(b) Expected Price Increases 2/	0.8	0.4	
Sub-total	17.8	7.8	7.8
Disbursement will be at 45% of total expenditure.			
II. Equipment			
A. Through Fiji Development Bank			
1. Seaqaqa Settlement			
(a) Farm Development	0.3	0.1	
(b) Tractors, Trailers, and Implements	0.6	0.4	
(c) Cane Transport Vehicles	0.9	0.7	
(d) Township Development	0.1	0.1	
(e) Expected Price Increases 2/	0.2	0.1	
B. By Government Directly			
1. Seaqaqa Settlement			
(a) Roads	1.8	1.4	
(b) Expected Price Increases 2/	0.2	0.1	
2. Drainage Improvement	0.1	0.1	
Sub-total	4.2	3.0	3.0
Disbursement will be at 100% of foreign expenditure for directly imported equipment or 70% of total expenditure for imported equipment procured locally.			
III. Unallocated			
Physical Contingencies	2.4	1.2	1.2
(Engineering, Supervision & Admin.)	(1.6)	-	
TOTAL	26.0	12.0	12.0

1/ See Annex 4, Table 1
2/ See Annex 4, Table 2

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SUGAR DEVELOPMENT PROJECT

Production, Farm Operating Costs and Farm Budgets-Seaqaqa Settlement

1. Agricultural practices in the settlement area are described in Annex 2. This Annex estimates sugarcane production, farm costs and incomes for typical settlers.

2. Table 1 shows the production plan over time of a 50-ac farm at Seaqaqa with 15 ac of sugarcane. Land clearing and farm development would proceed at 5 ac per year for the first three years. It is assumed that the farmer would replant 3 ac of his worst cane beginning in year four and would continue this cycle until year seven, at which time the rotation would stabilize at 3 ac of plant cane planted and 9 ac of ratoons cultivated each year. FSC's extension agents would emphasize limiting the number of ratoons to three. The annual harvested area would be 12 ac.

3. The assumption that replanting begins in year 4 rather than allowing the first plant cane to grow for a full three ratoons implies lower production and higher farm operating costs in years four through seven. It is based on field observations at Seaqaqa that many existing settlers have low yielding cane on part of their initial plantings due to poor soils, inadequate fertilizer applications or other farm management problems. The assumption therefore seems realistic.

4. Yields are assumed to be 24 ton/ac for plant cane, 22 ton/ac for first ratoon, 19 ton/ac for second ratoon and 16 ton/ac for third ratoon, or an average of 20 ton/ac harvested at full development, and are consistent with field observations. Total production per farm with these area and yield assumptions would be 243 tons at full development.

5. Table 2 presents total sugarcane production from the 8,000 ac to be developed under the project. At full development in year eight, incremental production is estimated to be about 130,000 tons.

6. Table 3 presents crop production costs per ac at both financial and economic prices while Table 4 shows monthly labor requirements per farm. Table 5 shows the cash flow projection for a typical settler with no sugarcane developed prior to the project. Investment cost would be F$1,370 in year one for land clearing, survey charges and housing materials, and F$860 in years two and three for land clearing. Farm development costs would be F$875 for each of the first three years. The farmer would receive a loan from the Fiji Development Bank (FDB) in years one, two and three covering all investment costs. The first year's loan would also include farm

development costs and a F$400 subsistence allowance so that the farmer's net cash flow in year one roughly equals his pre-project income from other sources. Farmers would repay these loans over five years at 4% interest beginning in year four. Payments would amount to about F$1,080 each year in nominal terms and are shown in Table 5 in terms of 1975 constant prices. Cash income would be from the sale of sugarcane plus earnings as a member of a cane harvesting gang, estimated at F$600 per crushing season regardless of production on his own farm. Net cash flow would increase from F$840 pre-project and F$870 in project year one to F$2,700 - F$3,150 (depending on the proportion of plant cane and various ratoons) during the loan repayment period and would be F$3,400 per year after the loan is repaid. Although there will be deviations in practice between this typical case and actual farm situations due to differences in land clearing costs, yields, cash inputs, etc., the analysis shows that in general, farmers would be able to repay their loans from FDB on the proposed terms, would have no problems in covering subsistence needs, and would have an adequate financial incentive to participate in the project.

7. Table 6 presents total farm operating costs for the 8,000 ac project area at economic prices for use in estimating net benefits for the economic analysis (Annex 10).

FIJI

SUGAR DEVELOPMENT PROJECT

Seaqaqa Settlement

Sugarcane Production - 50 ac Farm with 15 ac Sugarcane

	Pre-project	Year 1	2	3	4	5	6	7-30	Yield (ton/ac)
Area (ac)									
Plant Cane (Planted)	-	5	5	5	3	3	3	3	-
Plant cane (Cut)	-	-	5	5	5	3	3	3	24
1st ratoon	-	-	-	5	5	5	3	3	22
2nd ratoon	-	-	-	-	2	4	5	3	19
3rd ratoon	-	-	-	-	-	-	1	3	16
Total Area Planted	-	5	10	15	15	15	15	15	
Total Area Harvested	-	-	5	10	12	12	12	12	
Production (tons)									
Plant Cane	-	-	120	120	120	72	72	72	
1st ratoon	-	-	-	110	110	110	66	66	
2nd ratoon	-	-	-	-	38	76	95	57	
3rd ratoon	-	-	-	-	-	-	16	48	
Total	-	-	120	230	268	258	249	243	

ANNEX 7
Table 1

FIJI

SUGAR DEVELOPMENT PROJECT

Seaqaqa Settlement

Sugarcane Production with the Project 1/
('000 tons)

	Pre-Project	Year 1	2	3	4	5	6	7	8-30 2/
Project Area (8,000 ac)									
First 2,000 ac	-	-	48.0	44.0	38.0	38.4	35.2	30.4	25.6
Second 2,000 ac	-	-	-	48.0	44.0	38.0	38.4	35.2	30.4
Third 2,000 ac	-	-	-	-	48.0	44.0	38.0	38.4	35.2
Fourth 2,000 ac	-	-	-	-	-	48.0	44.0	38.0	38.4
TOTAL	-	-	48.0	92.0	130.0	168.4	155.6	142.0	129.6

1/ Assumes 2,000 ac cleared and planted each year for four years. Each 15 ac farm would be developed over three years at the rate of 5 ac/year (Table 1). Replanting would begin in year four and 80% of the area would be harvested each year thereafter. Yields are assumed to be 24 ton/ac for plant cane, 22 ton/ac for first ratoon, 19 ton/ac for second ratoon and 16 ton/ac for third ratoon. The average yield per ac harvested at full development would be 20 ton/ac.

2/ Repeat cycle.

ANNEX 7
Table 2

FIJI

SUGAR DEVELOPMENT PROJECT

Seaqaqa Settlement

Crop Production Costs

	Future With Project	
Cash Inputs (F$/ac)	Financial	Economic
Plant Cane		
Land Preparation 1/	24	27
Seed Cane 2/	45	51
Fertilizer - Development period 3/	82	93
(Fertilizer - Recurrent period) 3/	(55)	(62)
Cultivation	12	12
Other	12	12
Sub-Total-Development period	175	195
-(Recurrent period)	(148)	(164)
Ratoons		
Fertilizer - Development period 4/	60	68
(Fertilizer- Recurrent period) 4/	(34)	(38)
Cultivation	10	10
Other	4	4
Sub-Total-Development period	74	82
-(Recurrent period)	(48)	(52)
Harvesting 5/	80	80
Transport to Tambia railhead 6/	40	45
Labor Inputs (man-days/ac)		
Plant Cane	19	
Ratoons	7	
(Harvesting) 7/	(14)	

1/ 8 hours plowing, harrowing and furrowing @ F$3/hour (financial) and F$3.4/hr (economic).
2/ 1.75 tons @ F$26/ton (financial) and F$29/ton (economic).
3/ 7 cwt sulphate of ammonia (21-0-0), 5 cwt superphosphate (0-19-0) and 1 cwt muriate of potash (0-0-58). Prices are based on actual farm gate prices in mid-1975 and Bank commodity price forecasts to 1985, and are as follows (F$/cwt).

Fertilizer	Development Period (First 3 years)		Recurrent Period (Year 4 and later)	
	Financial	Economic	Financial	Economic
(21-0-0)	8.47	9.57	4.50	5.08
(0-19-0)	4.28	4.84	3.25	3.67
(0-0-58)	8.29	9.37	7.00	7.91

4/ 6 cwt sulphate of ammonia and 2 cwt superphosphate.
5/ F$ 4/ton x 20 ton/ac average yield at full development.
6/ F$ 2/ton (financial) and F$2.26/ton (economic) x 20 ton/ac average yield at full development.
7/ Costed as a cash input.

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SUGAR DEVELOPMENT PROJECT

Seaqaqa Settlement

Monthly Labor Requirements for 50 ac Farm with 15 ac Sugarcane[1/]

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Plant Cane (3 ac)													
Planting[2/]	-	-	-	-	-	-	-	18	-	-	-	-	18
Weeding and Fertilizing[2/]	15	6	-	-	-	-	-	-	-	6	6	6	39
Ratoons (9 ac)	9	-	-	-	-	-	9	-	18	9	9	9	63
General (15 ac)	-	3	3	-	-	-	-	-	-	-	-	-	6
Harvesting (12 ac) [3/]	-	-	-	-	16	26	26	26	26	26	15	-	162
TOTAL	24	9	3	-	16	26	35	44	44	41	31	15	288

1/ At full project development. The farm is assumed to be on a 5-year rotation of 3 ac plant cane, 3 x 3 = 9 ac ratoons and 3 ac fallow or under legumes. No labor is allowed for the legume crop. Tractors will be hired for field operations as follows:

Land Preparation (3 ac)	- 24 hours
Cultivation of Plant Cane (3 ac)	- 9 hours
Cultivation of ratoons (9 ac)	- 18 hours
Fallow/Legume (3 ac)	- 12 hours
Total	63 hours

2/ With use of tractors for major operations, planting, fertilizing and the remaining weeding would not require adult male labor.

3/ Assumed to be carried out by gangs composed 60% of farmers and family members and 40% of outside cutters. See Annex 2, para 3.

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SUGAR DEVELOPMENT PROJECT

ANNEX 7
Table 5

Seaqaqa Settlement

Cash Flow Projections for 50 ac Farm with 15 ac Sugarcane
(F$)

				Year							
I. Cash Inflow		Pre-Project 1/	1	2	3	4	5	6	7	8	9-30
Sugarcane Sales 2/	(1)	840	-	2,640	5,060	5,896	5,676	5,478	5,346	5,346	5,346
Harvesting in Gang 3/		-	600	600	600	600	600	600	600	600	600
Gross Farm Income		-	600	3,240	5,660	6,496	6,276	6,078	5,946	5,946	5,946
FDB Loan											
Investment 4/		-	1,370	860	860	-	-	-	-	-	-
Farm Development 5/		-	875	-	-	-	-	-	-	-	-
Subsistence Allowance 6/		-	400	-	-	-	-	-	-	-	-
Interest Capitalized 7/		-	105	145	185	-	-	-	-	-	-
Total Inflow	(2)	840	3,350	4,245	6,705	6,496	6,276	6,078	5,946	5,946	5,946
II. Cash Outflow											
Investment Cost											
Land Clearing 8/		-	860	860	860						
Survey Charges 9/		-	350	-	-						
Housing 10/		-	160	-	-						
Sub-Total Investment Cost	(3)	-	1,370	860	860						
Farm Development Cost 11/	(4)	-	875	875	875						
Annual Production Cost											
Cultivation of Ratoons 12/		-	-	370	370	336	432	432	432	432	432
Replanting 13/		-	-	-	-	444	444	444	444	444	444
Harvesting & Transport 14/		-	-	720	1,380	1,608	1,548	1,494	1,458	1,458	1,458
Rent 15/		-	130	130	130	130	130	242	242	242	242
Sub-Total Production Cost	(5)	-	130	1,220	1,880	2,518	2,554	2,612	2,576	2,576	2,576
Interest Capitalized 7/		-	105	145	185	-	-	-	-	-	-
Debt Service 16/		-	-	-	-	823	769	718	672	627	-
Total Outflow	(6)	-	2,480	3,100	3,800	3,341	3,323	3,330	3,248	3,203	2,576
III. Net Cash Flow (2) - (6)	(7)	840	870	1,145	2,905	3,155	2,953	2,748	2,698	2,743	3,370
Incremental Net Cash Flow 17/		-	30	305	2,065	2,315	2,113	1,908	1,858	1,903	2,530
IV. Financial Benefit/Cost											
Benefit 18/	(8)	-	(840)	1,800	4,220	5,056	4,836	4,638	4,506	4,506	4,506
Cost (3) + (4) + (5)	(9)	-	2,375	2,955	3,615	2,518	2,554	2,612	2,576	2,576	2,576
Net Benefit (8) - (9)		-	(3,215)	(1,155)	605	2,538	1,714	1,772	1,930	1,930	1,930

V. Financial Rate of Return: 33%

1/ Net cash flow from non-sugarcane sources roughly estimated at F$840.
2/ Production from Table 1 @ F$22/ton.
3/ One full-time adult gang member per family, 1.5 tons/man-day x 100 days x F$4/ton cut and loaded.
4/ 100% of (3).
5/ 100% of (4) in first year.
6/ Advance from FSC in first year incorporated in FDB loan.
7/ During the first three years, interest is capitalized at 4% annual interest.
8/ 5 ac/year-14% lightbush @ F$65/ac, 43% medium bush @ F$130/ac and 43% heavy bush @ F$250/ac = F$172/ac.
9/ 50 ac @ F$7/ac.
10/ Include 20 sheets galvanized iron. Other materials and labor to be provided by the farmer.
11/ Land preparation, seed cane, fertilizer, cultivation and other costs for development period from Table 3, 5 ac/year @ F$175/ac.
12/ Five year rotation, 9 ac of ratoons each year at full development. Financial costs from Table 3 total F$74/ac for development period and F$48/ac for recurrent period.
13/ Five year rotation, 3 ac of replanting each year beginning to year 4. Financial costs from Table 3 total F$148/ac.
14/ F$6/ton financial cost.
15/ Sugarcane area, F$7.50/ac for first 5 years, F$15/ac thereafter; for other land, F$0.50/ac. 75% would go to the owning mataqali and 25% to NLTB.
16/ An equal sum amortization over 5 years beginning in year 4 on F$4,365 in principal and F$435 in capitalized interest, discounted at 7% annual interest for expected general inflation.
17/ (7) in each year minus (7) pre-project.
18/ (1) in each project year minus (1) pre-project.

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SUGAR DEVELOPMENT PROJECT

Seaqaqa Settlement

Farm Operating Costs [1/]
(F$ '000)

Production Costs	Unit Cost (F$)	Pre-project	Year 1	2	3	4	5	6	7	8-30 [2/]
First 2,000 ac										
Plant cane - development period	195/ac	-	390	-	-	-	-	-	-	-
Plant cane - recurrent period	164/ac	-	-	-	-	263	-	-	-	263
Ratoons - development period	82/ac	-	-	164	164	-	-	-	-	-
Ratoons - recurrent period	52/ac	-	-	-	-	-	83	83	83	-
Sub-total		-	390	164	164	263	83	83	83	263
Second 2,000 ac		-	-	390	164	164	263	83	83	83
Third 2,000 ac		-	-	-	390	164	164	263	83	83
Fourth 2,000 ac		-	-	-	-	390	164	164	263	83
Total Production Costs		-	390	554	718	981	674	593	512	512
Harvesting and Transport Costs	6.26/ton	-	-	300	576	814	1,054	974	889	812
Total Farm Operating Costs		-	390	854	1,294	1,795	1,728	1,567	1,401	1,324

1/ Based on Tables 1, 2 and 3 at economic prices. Excludes the cost of farm labor other than for harvesting.

2/ Repeat cycle.

ANNEX 7
Table 6

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SUGAR DEVELOPMENT PROJECT

Production, Farm Operating Costs and Farm Budgets - Drainage Improvement

1. Agricultural practices in the drainage improvement areas are described in Annex 3. This Annex estimates sugarcane production, farm costs and incomes for typical farmers.

2. Table 1 shows the production plan over time of a 10-ac farm with saltwater intrusion initially. It is assumed that 3 ac are now out of production and under saltwater, which is the average for the 11,000 ac area as a whole. Seven ac are under cane and five ratoons (or more in some cases) are taken off. Seawalls and internal drains would be repaired in year one. At the same time, the extension agent would work with the farmer to reduce the number of ratoons to a maximum of three. During the slack season the farmer would repair his on-farm drains and would bund the saline land behind the seawalls to hasten leaching. After three years of leaching, he could plant a salt-tolerant variety of paddy on the landward part of the reclaimed area and extend the planted area seaward year by year. The value of the paddy crop would be less than 2% of the income from sugarcane, and has been disregarded in the farm income analysis. After another two years he could begin planting sugarcane. The total area planted would reach 10 ac in year eight and the rotation would stabilize in year twelve with 2 ac of plant cane planted and 6 ac of ratoons cultivated each year. The annual harvested area would be 8 ac. Average yields would increase from 20 ton/ac harvested at present to 26 ton/ ac at full development, and production would increase from 120 tons to 208 tons.

3. Table 2 shows a similar progression for a 10-ac farm with restricted drainage initially. An average of 2.3 ac are out of cane production at present due to waterlogging and are either left fallow or sown to paddy. The value of the paddy crop would only add about 10% to farm income before the project, and would not affect the analysis or conclusions significantly. It has therefore been disregarded. Internal common user and on-farm drains would be rehabilitated in year one and the number of ratoons would be reduced over time from five or more at present to three at full development. It is assumed that the rotation would stabilize in year six with 2 ac of plant cane planted and 6 ac of ratoons cultivated each year. The annual harvested area would be 8 ac. Average yields would increase from 21 ton/ac harvested at present to 26 ton/ac at full development, and production would increase from 140 tons to 208 tons.

4. Table 3 presents total sugarcane production with the project for the entire 26,400 ac project area. Production would increase from 346,000

tons cane at present to 549,000 tons at full development in year 16, or an increment of some 200,000 tons annually. Without the project, it is likely that production from these areas would decline more than it has already.

5. Table 4 presents crop production costs per ac at both financial and economic prices while Table 5 shows monthly labor requirements per farm, assumed to be the same for the entire area. Tables 6 and 7 show cash flow projections for farms with saltwater intrusion and restricted drainage, respectively, over the life of the project. The results are similar and are discussed here for the case of saltwater intrusion only. Investment cost would be F$1,200 in year one for internal drainage improvement. It is assumed that the Government would bear the cost of repairing seawalls at the same time. Drainage Boards would finance the internal drainage improvements with loans from FDB, which they would repay over ten years at 10% interest. The Drainage Boards would levy a drainage rate on farmers in their areas to cover these loan repayments plus the cost of operating and maintaining the seawalls and common user drains, estimated at F$6/ac. Payments per farm would amount to F$195 in nominal terms each year for ten years for debt service and F$60 each year in terms of 1975 constant prices for the life of the project for O&M costs. The total drainage rate is presented in Table 6 in terms of 1975 constant prices. Cash income would be from the sale of sugarcane plus harvesting as a gang member. Net cash flow would increase from F$2,180 before the project to F$3,590 in the last year of repayment and F$3,660 after the repayment period. The analysis shows that farmers would be able to pay the proposed drainage rates and still realize substantial financial benefits.

6. Finally, Table 7 presents total farm operating costs for the 26,400 ac project area at economic prices for use in estimating net benefits for the economic analysis (Annex 10).

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SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Sugarcane Production - 10 ac Farm with Saltwater Intrusion

	Pre-project	Year 1	2	3	4	5	6	7	8	9	10	11	12-30
Area Planted to Sugarcane (ac)													
5th ratoon	1.0	0.5	-	-	-	-	-	-	-	-	-	-	-
Plant cane (planted)	1.0	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	2.0	2.0	2.0	2.0
Plant cane (cut)	1.0	1.0	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	2.0	2.0	2.0
1st ratoon	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	2.0	2.0
2nd ratoon	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	2.0	2.5	2.5	2.0
3rd ratoon	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.0	1.0	1.5	2.0
4th ratoon	1.0	1.0	1.0	0.5	-	-	-	-	-	-	-	-	-
Total area planted	7.0	7.0	7.0	7.0	7.0	7.0	8.0	9.0	10.0	10.0	10.0	10.0	10.0
Total area harvested	6.0	5.5	5.5	5.5	5.5	5.5	6.0	6.5	7.5	8.0	8.0	8.0	8.0
Other Arable Land (ac)	3.0 1/	3.0 1/	3.0 1/	3.0 1/	3.0 2/	3.0 2/	2.0 2/	1.0 2/	-	-	-	-	-
Average Yield (ton/ac)	20	21	22	23	24	25	25	25	25	25	25	25	26
Production (tons)	120	116	121	126	132	138	150	162	188	200	200	200	208

1/ Unused due to salt water.

2/ Unused or under salt-tolerant paddy after seawalls are repaired and land is bunded and leached for 3 years. Paddy production would add about 2% to the value of gross farm income in years 4 through 7 (Table 6). It would not affect the analysis or conclusions significantly. Sugarcane planting would begin year 5 on the landward part of the area and would take 3 years to cover the entire reclaimed part of the farm.

ANNEX 8
Table 1

FIJI

SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Sugarcane Production - 10 ac Farm with Restricted Drainage

	Pre-project	Year 1	2	3	4	5	6-30
Area Planted to Sugarcane (ac)							
5th ratoon	1.1	-	-	-	-	-	-
Plant cane (planted)	1.1	2.2	3.4	2.0	2.0	2.0	2.0
Plant cane (cut)	1.1	1.1	2.2	3.4	2.0	2.0	2.0
1st ratoon	1.1	1.1	1.1	2.2	3.4	2.0	2.0
2nd ratoon	1.1	1.1	1.1	1.1	2.2	3.4	2.0
3rd ratoon	1.1	1.1	1.1	1.1	0.4	0.6	2.0
4th ratoon	1.1	1.1	1.1	0.2	-	-	-
Total area planted	7.7	7.7	10.0	10.0	10.0	10.0	10.0
Total area harvested	6.6	5.5	6.6	8.0	8.0	8.0	8.0
Other Arable Land (ac) 1/	2.3	2.3	-	-	-	-	-
Average Yield (ton/ac)	21	22	23	24	25	25	26
Production (tons)	139	121	152	192	200	200	208

1/ Unused due to waterlogging or under paddy. Paddy production would add about 10% to the value of gross farm income before the project (Table 7). It would not affect the analysis or conclusions significantly.

ANNEX 8
Table 2

FIJI

SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Sugarcane Production With the Project[1/]
('000 tons)

	Pre-Project	Year 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16-30
Saltwater Intrusion (11,000 ac)																	
First 5,000 ac	60.0	58.0	60.5	63.0	66.0	69.0	75.0	81.0	94.0	100.0	100.0	100.0	104.0	104.0	104.0	104.0	104.0
Second 1,300 ac	15.6	15.6	15.1	15.7	16.4	17.2	17.9	19.5	21.1	24.4	26.0	26.0	26.0	27.0	27.0	27.0	27.0
Third 1,700 ac	20.4	20.4	20.4	19.7	20.6	21.4	22.4	23.5	25.5	27.5	32.0	34.0	34.0	34.0	35.4	35.4	35.4
Fourth 1,500 ac	18.0	18.0	18.0	18.0	17.4	18.2	18.9	19.8	20.7	22.5	24.3	28.2	30.0	30.0	30.0	31.2	31.2
Fifth 1,500 ac	18.0	18.0	18.0	18.0	18.0	17.4	18.2	18.9	19.8	20.7	22.5	24.3	28.2	30.0	30.0	30.0	31.2
Sub-total	132.0	130.0	132.0	134.4	138.4	143.2	152.4	162.7	181.1	195.1	204.8	212.5	222.2	225.0	226.4	227.6	228.8
Restricted Drainage (15,400 ac)																	
First 2,000 ac	27.8	24.2	30.4	38.4	40.0	40.0	41.6	41.6	41.6	41.6	41.6	.	.	.	.	.	41.6
Second 3,100 ac	43.1	43.1	37.5	47.1	60.0	62.0	62.0	64.5	64.5	64.5	64.5	.	.	.	.	.	64.5
Third 3,500 ac	48.7	48.7	48.7	42.4	53.2	67.2	70.0	70.0	72.8	72.8	72.8	.	.	.	.	.	72.8
Fourth 3,500 ac	48.7	48.7	48.7	48.7	42.4	53.2	67.2	70.0	70.0	72.8	72.8	.	.	.	.	.	72.8
Fifth 3,300 ac	45.9	45.9	45.9	45.9	45.9	39.9	50.2	63.4	66.0	66.0	68.6	.	.	.	.	.	68.6
Sub-total	214.2	210.6	211.2	222.5	241.5	262.3	291.0	309.5	314.9	317.7	320.3	.	.	.	.	.	320.3
TOTAL	346.2	340.6	343.2	356.9	379.9	405.5	443.4	472.2	496.0	512.8	525.1	532.8	542.5	545.3	546.7	547.9	549.1
INCREMENTAL		-5.6	-3.0	10.7	33.7	59.3	97.2	126.0	149.8	166.6	178.9	186.6	196.3	199.1	200.5	201.7	202.9

1/ Production per 10 ac farm from Tables 1 and 2, multiplied by areas improved each year.

ANNEX 8
Table 3

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ANNEX 8
Table 4

SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Crop Production Costs

	Present and Future with Project	
Cash Inputs (F$/ac)	**Financial**	**Economic**
Plant Cane		
Land Preparation 1/	18	18
Seed Cane 2/	45	50
Fertilizer - Development Period 3/	37	42
(Fertilizer - Recurrent Period) 3/	(21)	(24)
Cultivation	12	12
Other	12	12
Sub-total - Development period	124	134
- (Recurrent period)	(108)	(116)
Ratoons		
Fertilizer - Development Period 3/	37	42
(Fertilizer - Recurrent Period) 3/	(21)	(24)
Cultivation	10	10
Other	4	4
Sub-total - Development Period	51	56
- (Recurrent Period)	(35)	(38)
Harvesting 4/	104	104

Labor Inputs (man-days/ac)	
Plant Cane	45
Ratoons	16
(Harvesting) 5/	17

1/ In March, 2 plowings and 2 harrowings by bullock @ 3 days/ac; in April, 1 furrowing @ 3 days/ac. Excludes cost of driver.

2/ 1.75 tons @ F$26/ton (financial) and F$29/ton (economic).

3/ 5 cwt of a 3:1 sulphate of ammonia (21-0-0) and superphosphate (0-19-0) mixture. Prices are based on actual farm gate prices in mid-1975 and Bank commodity price forecasts to 1985, and are as follows (F$/cwt):

Fertilizer	Development Period (First 5 years)		Recurrent Period (Year 6 & Later)	
	Financial	Economic	Financial	Economic
(21-0-0)	8.47	9.57	4.50	5.08
(0-19-0)	4.28	4.84	3.25	3.67

4/ F$4/ton x 26 ton/ac average yield at full development.

5/ Costed as a cash input.

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SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Monthly Labor Requirements for 10 ac Farm[1/]

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Plant Cane (2ac)													
Land Preparation[2/]	-	-	24	6	-	-	-	-	-	-	-	-	30
Planting	-	-	-	12	-	-	-	-	-	-	-	-	12
Inter-row Cultivation	-	-	-	-	-	6	-	6	6	-	-	-	18
Weeding and Fertilizing	-	-	-	-	-	9	-	6	9	6	-	-	30
Ratoons (6 ac)	-	-	-	-	-	12	24	12	12	12	24	-	96
General (10 ac)	3	3	-	-	-	-	-	-	-	-	-	-	6
Harvesting (8 ac)	-	-	-	-	15	24	24	24	24	24	15	-	150
TOTAL	3	3	24	18	15	51	48	48	51	42	39	-	342

1/ At full project development. No distribution is made between farms originally affected by saltwater intrusion and those affected by restricted internal drainage only. The farm is assumed to be on a 5-year rotation of 2 ac plant cane, 3 x 2 = 6 ac ratoons and 2 ac fallow or under legumes. No labor is allowed for the legume crop. All operations are carried out by bullock team or hand labor.

2/ In March, 2 plowings and 2 harrowings @ 3 days/ac; in April, 1 furrowing @ 3 days/ac.

ANNEX 8
Table 5

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SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Cash Flow Projections for 10 ac Farm with Saltwater Intrusion
(F$)

		Pre-Project	Year 1	2	3	4	5	6	7	8	9	10	11-30
I. Cash Inflow													
Sugarcane Sales[1]	(1)	2,640	2,552	2,662	2,772	2,904	3,036	3,300	3,564	4,136	4,400	4,576	4,576
Harvesting in Gang[2]		600	600	600	600	600	600	600	600	600	600	600	600
Gross Farm Income		3,240	3,152	3,262	3,372	3,504	3,636	3,900	4,164	4,736	5,000	5,176	5,176
Loan[3]		-	1,200	-	-	-	-	-	-	-	-	-	-
Total Inflow	(2)	3,240	4,352	3,262	3,372	3,504	3,636	3,900	4,164	4,736	5,000	5,176	5,176
II. Cash Outflow													
Investment Cost[4]	(3)	-	1,200	-	-	-	-	-	-	-	-	-	-
Annual Production Cost													
Planting & Replanting[5]		124	186	186	186	186	186	216	270	270	216	216	216
Cultivation of Ratoons[6]		255	230	204	204	204	204	158	158	175	192	210	210
Harvesting[7]		480	464	484	504	528	552	600	648	752	800	800	832
Rent[8]		200	200	200	200	200	200	200	200	200	200	200	200
Sub-Total Production Cost	(4)	1,059	1,080	1,074	1,094	1,118	1,142	1,174	1,276	1,397	1,408	1,426	1,458
Drainage Rate													
Debt Service[9]		-	182	170	159	149	139	130	121	113	106	99	-
O&M Charge[10]		-	60	60	60	60	60	60	60	60	60	60	60
Sub-Total Drainage Rate		-	242	230	219	209	199	190	181	173	166	159	60
Total Outflow	(5)	1,059	2,522	1,304	1,313	1,327	1,341	1,364	1,457	1,570	1,574	1,585	1,518
III. Net Cash Flow: (2)-(5)	(6)	2,181	1,830	1,958	2,059	2,177	2,295	2,536	2,707	3,166	3,426	3,591	3,658
Incremental Net Cash Flow[11]			(351)	(223)	(122)	(4)	114	355	526	985	1,245	1,410	1,477
IV. Financial Benefit/Cost													
Incremental Benefit[12]	(7)		(88)	22	132	264	396	660	924	1,496	1,760	1,936	1,936
Incremental Cost[13]	(8)		1,221	15	35	59	83	115	217	338	349	367	399
Incremental Net Benefit: (7)-(8)	(9)		(1,309)	7	97	205	313	545	707	1,158	1,411	1,569	1,537

V. Financial Rate of Return: 33%

1/ Production from Table 1 @ F$22/ton.
2/ One full-time adult gang member per family, 1.5 tons/man-day x 100 days x F$4/ton cut and loaded.
3/ 100% of (3).
4/ Cost of internal drainage improvement borne by Drainage Boards of F$120/ac, including physical contingencies. Excludes the cost of on-farm drains and bunding of saline land for leaching, assumed to be done by family labor off-season.
5/ Areas from Table 1. Financial costs from Table 4 total F$124/ac for the first five years and F$108/ac thereafter.
6/ Areas from Table 1. Financial costs from Table 4 total F$51/ac for the first five years and F$35/ac thereafter.
7/ Production from Table 1 @ F$4/ton cut and loaded.
8/ F$20/ac. 75% would go to the owning mataqali and 25% to NLTB.
9/ An equal sum amortization over ten years on F$1,200 in principal, discounted at 7% annual interest for expected general inflation.
10/ Total cost of operating and maintaining seawalls and internal common user drains of F$6/ac.
11/ (6) in each project year minus (6) pre-project.
12/ (1) in each project year minus (1) pre-project.
13/ (3) plus (4) in each project year minus (4) pre-project.

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SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Cash Flow Projections for 10 ac Farm with Restricted Drainage
(F$)

		Pre-Project	Year 1	2	3	4	5	6	7	8	9	10	11-30
I. Cash Inflow													
Sugarcane Sales[1]	(1)	3,058	2,662	3,344	4,224	4,400	4,400	4,576	.	.	.	.	4,576
Harvesting in Gang[2]		600	600	600	600	600	600	600	.	.	.	.	600
Gross Farm Income		3,658	3,262	3,944	4,824	5,000	5,000	5,176	.	.	.	.	5,176
Loan[3]		-	1,000	-	-	-	-	-	-	-	-	-	-
Total Inflow	(2)	3,658	4,262	3,944	4,824	5,000	5,000	5,176	.	.	.	.	5,176
II. Cash Outflow													
Investment Cost[4]	(3)	-	1,000	-	-	-	-	-	-	-	-	-	-
Annual Production Cost													
Planting & Replanting[5]		136	273	422	248	248	248	216	.	.	.	.	216
Cultivation of Ratoons[6]		280	224	224	235	306	306	210	.	.	.	.	210
Harvesting[7]		556	484	608	768	800	800	832	.	.	.	.	832
Rent[8]		200	200	200	200	200	200	200	.	.	.	.	200
Sub-Total Production Costs	(4)	1,172	1,181	1,454	1,451	1,554	1,554	1,458	.	.	.	.	1,458
Drainage Rate													
Debt Service[9]		-	152	142	133	124	116	108	101	95	88	83	-
O&M Charge[10]		-	60	60	60	60	60	60	.	.	.	.	60
Sub-Total Drainage Rate		-	212	202	193	184	176	168	161	155	148	143	60
Total Outflow	(5)	1,172	2,393	1,656	1,644	1,738	1,730	1,626	1,619	1,613	1,606	1,601	1,518
III. Net Cash Flow: (2)-(5)	(6)	2,486	1,869	2,288	3,180	3,262	3,270	3,550	3,557	3,563	3,570	3,575	3,658
Incremental Net Cash Flow[11]			(617)	(198)	694	776	784	1,064	1,071	1,077	1,084	1,089	1,172
IV. Financial Benefit/Cost													
Incremental Benefit[12]	(7)		(396)	286	1,166	1,342	1,342	1,518	.	.	.	.	1,518
Incremental Cost[13]	(8)		1,009	282	279	382	382	286	.	.	.	.	286
Incremental Net Benefit: (7)-(8)	(9)		(1,405)	4	887	960	960	1,232	.	.	.	.	1,232

V. Financial Rate of Return: 49%

1/ Production from Table 2 @ F$22/ton.
2/ One full-time adult gang member per family, 1.5 tons/man-day x 100 days x F$4/ton cut and loaded.
3/ 100% of (3).
4/ Cost of internal drainage improvement borne by Drainage Boards of F$100/ac, including physical contingencies. Excludes the cost of on-farm drains, assumed to be done by family labor off-season.
5/ Areas from Table 2. Costs from Table 4 total F$124/ac for the first five years and F$108/ac thereafter.
6/ Areas from Table 2. Costs from Table 4 total F$51/ac for the first five years and F$35/ac thereafter.
7/ Production from Table 2 @ F$4/ton cut and loaded.
8/ F$20/ac. 75% would go to the owning mataqali and 25% to NLTB.
9/ An equal sum amortization over 10 years on F$1,000 in principal, discounted at 7% annual interest for expected general inflation.
10/ Total cost of operating and maintaining seawalls and internal common user drains of F$6/ac.
11/ (6) in each project year minus (6) pre-project.
12/ (1) in each project year minus (1) pre-project.
13/ (3) plus (4) in each project year minus (4) pre-project.

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SUGAR DEVELOPMENT PROJECT

Drainage Improvement

Farm Operating Costs[1/]
(F$ '000)

	Pre-project	Year 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16-30
Production Costs																	
a. Saltwater Intrusion (11,000 ac)																	
First 5,000 ac																	
Plant Cane	67	100	100	100	100	100	116	145	145	116	116	116	116	116	116	.	116
Ratoons	141	126	112	112	112	112	86	86	96	104	114	114	114	114	114	.	114
Sub-Total	208	226	212	212	212	212	202	231	241	220	230	230	230	230	230	.	230
Second 1,300 ac	54	54	59	55	55	55	55	53	61	63	57	60	60	60	60	.	60
Third 1,700 ac	71	71	71	77	72	72	72	72	69	79	82	75	78	78	78	.	78
Fourth 1,500 ac	62	62	62	62	67	64	64	64	64	61	69	73	66	69	69	.	69
Fifth 1,500 ac	62	62	62	62	62	67	64	64	64	64	61	69	73	66	69	.	69
Sub-Total Saltwater Intrusion	457	475	466	468	468	470	457	484	499	487	499	507	507	503	507	.	507
b. Restricted Drainage (15,400 ac)																	
First 2,000 ac																	
Plant Cane	29	59	91	54	54	54	46	46	46	46	46	.	.	.	.	.	46
Ratoons	61	49	49	52	67	67	46	46	46	46	46	.	.	.	.	.	46
Sub-Total	90	108	140	106	121	121	92	92	92	92	92	.	.	.	.	.	92
Second 3,100 ac	140	139	168	216	162	186	186	143	143	143	143	.	.	.	.	.	143
Third 3,500 ac	157	157	157	189	244	184	211	211	161	161	161	.	.	.	.	.	161
Fourth 3,500 ac	157	157	157	157	189	244	184	210	210	161	161	.	.	.	.	.	161
Fifth 3,300 ac	148	148	148	148	148	178	230	172	198	198	151	.	.	.	.	.	151
Sub-Total Restricted Drainage	692	709	770	816	864	912	903	828	804	755	708	.	.	.	.	.	708
Total Production Costs	1,149	1,184	1,236	1,284	1,332	1,382	1,360	1,312	1,303	1,242	1,207	1,215	1,215	1,211	1,215	.	1,215
Harvesting Costs	1,385	1,362	1,373	1,428	1,520	1,622	1,774	1,889	1,984	2,051	2,100	2,131	2,170	2,181	2,187	2,192	2,196
Total Farm Operating Costs	2,534	2,546	2,609	2,712	2,852	3,004	3,134	3,201	3,287	3,293	3,307	3,346	3,385	3,392	3,402	3,407	3,411
Incremental Farm Operating Costs		12	75	178	318	470	600	667	753	759	773	812	851	858	868	873	877

1/ Based on Tables 1, 2, 3 and 4 at economic prices. Excludes the cost of farm labor other than for harvesting.

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SUGAR DEVELOPMENT PROJECT

Cost and Benefit Recovery

1. This Annex examines the implications for public revenues and project beneficiary incomes and incentives of the Government's proposed cost recovery policies for various project components. Since the project would not provide irrigation water, efficiency of water use would not be an issue in determining appropriate project charges.

2. In determining the extent of cost recovery and its relation to benefits, three indices have been used which are defined as follows for the present project:

(a) Cost Recovery Index: the ratio of incremental direct payments for the project by all project beneficiaries to incremental project construction, operation and maintenance costs.

(b) Benefit Recovery Index: the ratio of incremental direct payments for the project by a typical farm family to incremental income accruing to the family before paying project charges.

The Benefit Recovery Index as defined above gives no feeling for how much of the incremental income due to the project it would be feasible or equitable to recover, since it ignores the value of family labor, management costs and uncertainty associated with farmers' efforts to achieve these incomes. Therefore the analysis also considers the

(c) Rent Recovery Index: the ratio of incremental direct payments for the project by a typical farm family to incremental "project rent" accruing to the family before paying project charges, where "project rent" is defined as incremental income as in (b) less the value of family labor, management costs and allowances for uncertainty.

The upper limit of the Rent Recovery Index is 100% but it would normally be less than that because of political difficulties, tax disincentives and costs of collecting taxes. Rent is a difficult concept to measure in practice, but an attempt is made to determine reasonable quantitative estimates of its various components based on qualitative considerations.

3. All project charges, costs and benefits are measured at present values discounted at 10% annual rate of interest over the period of repayment and in terms of 1975 constant prices. Costs are net of taxes and other

transfer payments. It is assumed that there would be no incremental payments of general taxes due to the project.

Seaqaqa Settlement

4. As in the farm budget analysis (Annex 7), only one farm size is considered, which represents the typical Seaqaqa settler on a 50-ac leasehold, of which 15 ac would be developed under the project for growing sugarcane. Although there will undoubtedly be departures from this norm as time goes on, such departures are not predictable at this time, and are not expected to be large in any case due to milling limitations for additional sugarcane and technical and marketing constraints for other crops.

5. The cost recovery analysis is limited to land clearing, first year farm development and farm access roads. The main road would be part of the national highway system and users including the settlers and township residents would be subject to Fiji's normal road user charges. Other project costs would be fully recovered from project beneficiaries in the following manner:

(a) The cost of the tramline extension would be borne by the Fiji Sugar Corporation (FSC), either from its own resources or by a loan from the Fiji Development Bank (FDB) to be repaid over 15 years at 10% interest. As is the case throughout Fiji, the miller would bear the total cost of rail transport from its share of sugar proceeds.

(b) The cost of tractors and cane transport vehicles would be borne by FSC, individual purchasers or the Native Land Development Corporation (NLDC). Loans from FDB would be repaid over five years (or as otherwise agreed between FDB and its borrowers) at 10% interest.

(c) The cost of township development would be borne by NLDC either from its own resources or by loans from FDB to be repaid at 10% interest with maturities as agreed between FDB and NLDC. As developer, NLDC would recover its investment from township residents through various rental, sale and service agreements.

6. The direct charge against project beneficiaries would be levied as repayment of FDB loans for land clearing, first year farm development and first year subsistence. The proposed terms are eight year maturity including three years' grace at 4% annual rate of interest. Collections would be made by FSC as a deduction from sugarcane proceeds. Indirectly, project beneficiaries would repay part of the public cost of farm access road construction and maintenance through road user charges in the form of license fees and fuel taxes, either for their own tractors or through hourly hire rates. 1/

1/ The license fee for farm tractors is F$5/year and the tax on diesel fuel as of mid-1975 was F$0.19/gal. Farm tractors are exempt from import duty.

7. Table 1 presents cost recovery indices for two different cases. In the first, the costs of land clearing, first year farm development and farm access road construction and maintenance are compared to debt service plus license and fuel taxes for farm tractors used for cultivation, in-field transport and transport of cane from field to pickup points on the main road. The resulting cost recovery index is 27%, which is to some extent an understatement of cost recovery since the farm access roads would be used by other vehicles, particularly buses, which would pay user charges. In the second case, the cost of constructing and maintaining the farm access roads and road user charges are both omitted. The resulting cost recovery index is 53%, reflecting the direct subsidy element of 47% of land clearing and first year farm development cost in the Government's interest rate policy for agricultural development loans.

8. As shown in Table 1, the typical settler's incremental cash income from the project at full development would be F$1,930 (US$2,300), or F$390 (US$460) per capita, compared with per capita income of roughly US$200 at present. Debt service payments in years four through eight would allow the farmer sufficient cash flow (Annex 7, Table 5) and yield a benefit recovery index of 34%. In computing project rent, incremental family labor was evaluated at F$6/man-day during the crushing season and F$3/man-day during the slack season as in the economic analysis (Annex 10). The value of farm management was taken as 10% of incremental net farm income at full development and an uncertainty allowance of 10% of incremental net farm income was assumed. The resulting rent recovery index is over 100%. Although, this figure is merely approximate, it does indicate that the proposed project charges are about as high as farmers could reasonably be expected to pay.

Drainage Improvement

9. As in the farm budget analysis (Annex 8), two types of farms are considered, representing areas now affected by saltwater intrusion and those affected by restricted internal drainage only. The Government proposes to reconstruct protective seawalls and tidal gates as a national expenditure which would not be recovered from beneficiaries. Construction of internal common user drains would be the responsibility of local Drainage Boards who would borrow funds for the purpose from FDB. Repayment would be over ten years at 10% interest, and would be recouped from beneficiary farmers in the Drainage Board areas through a drainage rate. The drainage rate would also include provision for the operation and maintenance of seawalls and tidal gates as well as internal drains. If farmers fail to pay drainage rates after notification by the Drainage Boards, FSC is empowered to deduct that amount from cane proceeds. Table 2 shows that the proposed charges would give a cost recovery index of 46% for seawalls and internal drainage combined, and 78% for internal drainage only.

10. Benefit and rent recovery indices have been computed for both saltwater intrusion and restricted drainage areas. The results are similar and this discussion will therefore be limited to the saltwater intrusion

case. As shown in Table 2, incremental net farm income from the project at full development would be F$1,537 (US$1,830) per family or F$307 (US$365) per capita, compared with a per capita income of US$590 at present. The proposed drainage rate would give a benefit recovery index of 46%. In computing the rent recovery index, the same percentage for incremental family labor and an uncertainty allowance were assumed as for Seaqaqa (para 8). The resulting rent recovery index is again over 100%, indicating that farmers would most likely be unwilling to participate in the project if higher rates were charged.

Conclusions

11. Table 3 summarizes the results. For the Seaqaqa settlement, the proposed charges yield a cost recovery index between 27% and 53% and a rent recovery index in excess of 100%. For the drainage improvement areas, the proposed drainage rates imply a cost recovery index of 78% for internal common user drains and 46% for both seawalls and drains, and rent recovery indices of 62% to over 100%. Although the rent recovery indices as computed are subject to a wide range of error, they do indicate that the proposed project charges are about as high as farmers would be willing to pay. These rates would capture 34% of incremental cash income from Seaqaqa settlers and 25%-46% of incremental cash income from beneficiaries of drainage improvement. The proposed rates therefore represent a reasonable contribution to project costs, and would appear to be just within the beneficiaries' ability and willingness to pay.

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SUGAR DEVELOPMENT PROJECT

Cost and Benefit Recovery

Seaqaqa Settlement

Cost Recovery - 8,000 ac project area

Year	A Case 1/ Cost 3/	A Case 1/ Recovery 4/	B Case 2/ Cost 5/	B Case 2/ Recovery 6/
	(F$ '000)			
1	1,530	7	500	0
2	950	14	530	0
3	1,030	21	590	0
4	940	131	480	110
5	-220	226	0	205
6	100	308	0	287
7	100	379	0	358
8	100	356	0	335
9	100	255	0	234
10	100	167	0	146
Cost Recovery Index		27%		53%

Benefit Recovery - 50 ac farm with 15 ac sugarcane

Year	Incremental Net Farm Income 7/	Incremental Farm Labor Cost 8/	Incremental Farm Management Cost 9/	Uncertainty Allowance 10/	Project Rent 11/	Recovery 12/
1	-970	200	190	-100	-1,260	0
2	-295	400	190	-30	-855	0
3	-1,465	600	190	150	525	0
4	2,538	600	190	250	1,498	823
5	2,282	600	190	230	1,262	769
6	2,026	600	190	200	1,036	718
7	1,930	600	190	190	950	672
8	1,930	600	190	190	950	627

Benefit Recovery Index: 34%

Rent Recovery Index: 112%

1/ Land clearing, farm development and access roads.
2/ Land clearing and farm development.
3/ Cost of land clearing, first year farm development and access road construction and maintenance.
4/ Debt service payments for land clearing and first year farm development, plus vehicle license fees and POL taxes for tractors aggregated over the settlement area.
5/ (3) above less the cost of constructing and maintaining farm access roads.
6/ (4) above less vehicle license fees and POL taxes for farm tractors.
7/ Sugarcane sales less farm development (years 2 and 3) and annual production costs from Annex 7, Table 5, less pre-project income.
8/ Incremental farm labor except for harvesting evaluated at F$6/man-day during the crushing season and F$3/man-day during the slack season.
9/ 10% of incremental net farm income at full development.
10/ 10% of incremental net farm income.
11/ Incremental net farm income less the sum of incremental farm labor and management costs and uncertainty allowance.
12/ Debt service payments from Annex 7, Table 5.

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SUGAR DEVELOPMENT PROJECT

Cost and Benefit Recovery

Drainage Improvement

Cost Recovery - 26,400 ac project area

Year	Cost A[1]	Cost B[2]	Recovery[3]
		(F$'000)	
1	1,702	462	164
2	1,028	698	248
3	1,230	820	342
4	1,230	850	421
5	1,198	818	490
6	158	158	468
7	158	158	448
8	158	158	429
9	158	158	411
10	158	158	394
11	158	158	317
12	158	158	273
13	158	158	228
14	158	158	190
Cost Recovery Index:	46%	78%	

Benefit Recovery - 10 ac farm with saltwater intrusion

Year	Incremental Net Farm Income[4]	Incremental family Labor Cost[5]	Incremental Farm Management Cost[6]	Uncertainty Allowance[7]	Project Rent[8]	Recovery[9]
			(F$)			
1	-109	144	150	-10	-393	242
2	7	19	150	-	-162	230
3	97	19	150	10	-82	219
4	205	19	150	20	16	209
5	313	19	150	30	114	199
6	545	173	150	50	172	190
7	707	276	150	70	211	181
8	1,158	325	150	120	563	173
9	1,411	272	150	140	849	166
10	1,569	321	150	150	948	159

Benefit Recovery Index: 46%

Rent Recovery Index: 175%

Benefit Recovery - 10 ac farm with restricted drainage

Year	Incremental Net Farm Income[10]	Incremental family Labor Cost[5]	Incremental Farm Management Cost[6]	Uncertainty Allowance[7]	Project Rent[8]	Recovery[11]
			(F$)			
1	-405	209	120	-40	-694	212
2	4	382	120	-	-498	202
3	887	112	120	90	565	193
4	960	248	120	100	492	184
5	960	248	120	100	492	176
6	1,232	248	120	120	744	168
7	1,232	248	120	120	744	161
8	1,232	248	120	120	744	155
9	1,232	248	120	120	744	148
10	1,232	248	120	120	744	143

Benefit Recovery Index: 25%

Rent Recovery Index: 62%

1/ Seawalls and internal common user drains - construction, operation and maintenance.
2/ Construction of internal common user drains plus operation and maintenance of seawalls and internal drains.
3/ Drainage rate aggregated over the project area.
4/ Incremental sugarcane sales less incremental annual production costs from Annex 8, Table 6.
5/ Incremental family labor except for harvesting evaluated at F$6/man-day during the crushing season and F$3/man-day during the slack season.
6/ 10% of incremental net farm income at full development.
7/ 10% of incremental net farm income.
8/ Incremental net farm income less the sum of incremental family labor and farm management costs and uncertainty allowance.
9/ Drainage rate from Annex 8, Table 6.
10/ Incremental sugarcane sales less incremental annual production costs from Annex 8, Table 7.
11/ Drainage rate from Annex 8, Table 7.

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SUGAR DEVELOPMENT PROJECT

Cost and Benefit Recovery Summary [1]

	Cost Recovery Index A	Cost Recovery Index B	Benefit Recovery Index (%)	Rent Recovery Index	Average Income with the Project after Repayment [2] Per Family (US$)	Per Capita (US$)
Seaqaqa Settlement	27	53	34	100+	4,010	800
Drainage Improvement	46	78	-	-		
Saltwater Intrusion	-	-	46	100+	4,350	870
Restricted Drainage	-	-	25	62	4,350	870

GDP per capita (1974): US$640 [3]

1/ From Tables 1 and 2.

2/ From Annex 7, Table 5 and Annex 8, Tables 6 and 7.

3/ Source: Government of Fiji, Bureau of Statistics, Current Economic Statistics, April 1975, Table 3.

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SUGAR DEVELOPMENT PROJECT

Economic Analysis

1. The Seaqaqa settlement and drainage improvement parts of the project have been analyzed separately since they would be carried out in two distinct areas by essentially different organizations and would benefit different groups of people. Within each part, however, a separate or incremental analysis of the various components would not be appropriate since each part constitutes an integrated package which would not yield the expected benefits if one or more components were missing. For example, the sugarcane production at Seaqaqa could not be processed on time without the proposed transport improvements, and the reconstruction of seawalls would not be beneficial without improvement of the internal drains behind them. On the other hand, the analysis of the Seaqaqa settlement does not attempt to quantify benefits other than those from increased cane production, which would result from the investments in infrastructure and township development.

Seaqaqa Settlement

2. Costs. Investment costs are taken as the full costs of land clearing, farm development, farm access roads and half the cost of main road construction and improvement. The costs of the tramline extension would be borne by the Fiji Sugar Corporation (FSC) and would generate benefits in the form of increased revenues for the Corporation from the miller's share of sugar proceeds. Half the main road costs have been excluded since at least half the traffic on the improved section, once the new transinsular road to Savusavu is completed, would be other than that related to the production and transport of sugarcane at Seaqaqa. Township development costs have been excluded since the township residents would benefit from and pay the Native Land Development Corporation (NLDC) for the facilities. The costs of tractors and cane transport vehicles have been treated as part of farm production costs in evaluating project benefits. O&M costs are included for the main and access roads. All costs include physical contingencies and are net of taxes and other transfer payments.

3. Foreign Exchange. Due to the existence of import taxes and quantitative restrictions, the official exchange rate understates the value to the economy of foreign exchange used in carrying out the project and earned by incremental sugar exports. In the absence of detailed information needed to compute specific conversion factors, the standard conversion

factor (SCF) for Fiji using the Squire - van der Tak approach 1/ is estimated at about 0.88 for the three years 1971-73. This ratio implies a shadow exchange rate of US$1.05 = F$1.00, which was used in the economic analysis.

4. Employment and Labor Costs. Labor requirements per 15-ac cane farm are presented in Annex 7. No distinction is made between family and hired labor. The bulk of employment would be created during the crushing season (June-November) and would consist mostly of harvesting. At full development, harvesting would require about 86,000 man-days of labor over the entire 8,000 ac to be developed under the project, or about 860 seasonal jobs. Due to the way harvesting is organized in gangs under FSC direction (Annex 2), harvest labor has been treated as a cash production cost at the peak season market wage of F$6/man-day. An additional 40,000 man-days (400 jobs) would be required during the crushing season for other farm operations, and 27,000 man-days (270 jobs) would be needed during the slack season. This additional labor was priced at F$6/man-day during the crushing season and at half that amount during the slack season to reflect the reduced availability of productive employment during that season. More than enough labor would be available from project farm families, other labor from Lambason and farms in the Seaqaqa vicinity, and seasonal labor from the outer islands. It should be noted that at F$6 (US$7.2)/man-day, Fiji is a relatively high wage society (about twice the estimated full employment rural wage rate in Korea).

5. Benefits. Benefits are defined as the incremental net return to the project area after deducting the cost of incremental farm labor other than for harvesting. Expected sugarcane yields, production, and production costs are shown in Annex 7. The farm gate prices for sugarcane used in the financial and economic analyses are based on the situation in Fiji as of mid-1975 and the Bank's world market price forecasts, and are presented in Table 1. Table 2 summarizes the benefits from the settlement at full development.

1/ L. Squire and H.G. van der Tak; Economic Analysis of Projects; Baltimore and London, The Johns Hopkins University Press, 1975. The formula used to estimate the SCF was:

$$\frac{X + M}{M(1 + Tax^M) + X(1 - Tax^X)}$$

where

M = value of merchandise imports cif
X = value of merchandise exports fob

TAX^M = weighted average rate of taxes on imports

TAX^X = weighted average rate of taxes on exports

The variable normally included in this equation to estimate the tariff equivalent of quantitative restrictions was omitted as the necessary information on tariff restrictions is not available in the Bank.

6. Development Period. According to the project implementation schedule, 2,000 ac would be cleared and planted to sugarcane each year for four years beginning in 1976. Each 15-ac farm would be developed over three years in 5-ac increments. Under the recommended pattern of plant cane and three ratoons, production would stabilize at the full development level in year eight.

7. Economic Rate of Return. Using the foregoing assumptions and discounting project costs and benefits over a 30-year evaluation period, the economic rate of return is estimated to be 20% (Table 3).

8. Sensitivity Analysis. Several of the assumptions made in the economic analysis have been varied in order to examine their impact on the rate of return. The results are presented in Table 4. If the full costs of the main road improvements, tramline extension and township development are included and benefits are unchanged, the rate of return would be 12%. Under a number of adverse assumptions the rate of return would exceed 13%.

Drainage Improvement

9. Costs. Investment costs are taken as the full costs of seawalls and internal drainage, including mapping, offices and vehicles for the Drainage and Irrigation Division (DID) and the imputed cost to farmers of improving on-farm drains. O& M costs are included for the seawalls, common user internal drains and the imputed cost of maintaining on-farm drains. All costs include physical contingencies and are net of taxes and other transfer payments.

10. Foreign Exchange. Foreign exchange costs and earnings are converted to local currency equivalents at a shadow exchange rate of US$1.05 = F$1.00 as for the Seaqaga settlement (para 3).

11. Employment and Labor Costs. Labor requirements per 10-ac cane farm are presented in Annex 8, Table 5. Labor costs are evaluated in the same way as the Seaqaqa settlement (para 3). At full development, harvesting would require an increment of about 135,000 man-days of labor over the 26,400 ac to be improved, or about 1,350 seasonal jobs. An additional 90,000 man-days (900 jobs) would be required during the crushing season for other farm operations and 55,000 man-days (550 jobs) would be needed during the slack season.

12. Benefits. Benefits are defined as for Seaqaqa (para 4). Expected yields, production and production costs are shown in Annex 8. Table 2 summarizes the benefits from drainage improvement at full development.

13. Development Period. According to the project implementation schedule, the entire 26,400 drainage improvement area would be completed over five years beginning in 1976. For the areas now affected by saltwater

intrusion, sugarcane would be planted only after reclamation and leaching for at least five years. Given the anticipated yield progression for plant cane and three ratoons, production from the 11,000 ac with saltwater intrusion would stabilize in year 16. For the areas with restricted internal drainage only, sugarcane could be planted on the entire area immediately after drainage is restored. Production from the 15,400 ac so affected is expected to stabilize after ten years.

14. Economic Rate of Return. Using the foregoing assumptions and discounting project costs and benefits over a 30-year evaluation period, the economic rate of return is estimated to be 20% (Table 3).

15. Sensitivity Analysis. Several of the assumptions have been varied to examine their impact on the rate of return. The results are presented in Table 4. In all of the cases tested the rate of return exceeded 13%.

Total Project

16. Combining the cost and benefit streams from the basic analysis of both parts of the project, the overall economic rate of return would be 20%.

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SUGAR DEVELOPMENT PROJECT

Prices for Sugar, 1975 and 1985 1/
(F$ or US$/ton at 1975 constant prices)

	1975			1985		
	F$/ton		US$/ton	F$/ton		US$/ton
	Economic 2/	Financial 3/		Economic 2/	Financial 3/	
Export price fob Lautoka/Lambasa	425	375	446	299	264	314
Less Certified Deductions 4/	-10	-10	-12	-10	-10	-12
Available for Distribution	415	365	434	289	254	302
Growers' Share (70%)	290	255	304	202	178	211
Sugarcane equivalent price at mill or railhead (8:1 conversion ratio)	36	32	38	25	22	26

1/ Based on actual situation in Fiji as of mid-1975 and IBRD Report No.814, Price Forecasts for Major Primary Commodities, July 1975.

2/ Based on shadow exchange rate of F$1.00=US$1.05

3/ Based on official exchange rate of F$1.00=US$1.17

4/ Costs of the Sugar Board, Advisory Council, Independent Chairman, Vice-Chairman and Accountant, export duty (2%), stabilization fund levy, marketing costs (0.67%) and research (F$1-2/ton).

ANNEX 10
Table 1

FIJI

SUGAR DEVELOPMENT PROJECT

Economic Analysis - Net Value of Production at Full Project Development

	Net Return to Project Area Without Costing Farm Labor (F$ '000)		Incremental Net Return (F$ '000)	Less Cost of Incremental Farm Labor 1/ (F$ '000)	Incremental Net Value of Production (F$ '000)	(US$ '000)
	Without Project	With Project				
Seaqaqa Settlement	958 2/	2,874 3/	1,916 4/	320	1,596	1,675
Drainage Improvement	6,121 5/	10,316 5/	4,195 5/	700	3,495	3,670

1/ Excluding harvest labor which is treated as a cash farm operating cost at the peak season market wage. The difference in the remaining farm labor requirement between "with" and "without" project conditions is costed at the peak season wage of F$6/man-day during the crushing season (June-November) and at F$3/man-day during the rest of the year.
2/ Net return from the 4,000 ac developed by end 1975 at full development.
3/ Net return from the full 12,000 ac under sugarcane in the settlement area.
4/ From Annex 7, Tables 2(production evaluated at F$25/ton) and 6.
5/ From Annex 8, Tables 3 (production evaluated at F$25/ton) and 8.

ANNEX 10
Table 2

FIJI

SUGAR DEVELOPMENT PROJECT

Economic Costs and Benefits 1/
(US$ '000)

Seaqaqa Settlement	Year	Costs						Benefits 2/
		Capital 3/				O & M 4/	Total	
		Land Clearing	Farm Development	Access Roads	½ Main Road			
	1	380	190	1,160	1,280	10	3,020	-490
	2	420	190	450	930	20	2,010	190
	3	480	0	450	0	50	980	800
	4	530	0	450	0	90	1,070	1,190
	5	0	0	0	0	140	140	2,770
	6	0	0	0	0	140	140	2,100
	7	0	0	0	0	140	140	1,920
	8-30	0	0	0	0	140	140	1,680

Economic Rate of Return: 20%

Drainage Improvement	Year	Costs					Benefits 5/
		Capital 3/			O & M 6/	Total	
		Seawalls 7/	Common User Drains	On-farm Drains			
	1	1,390	470	50	0	1,910	-360
	2	370	700	30	50	1,150	-470
	3	460	800	40	80	1,380	-370
	4	420	800	40	120	1,380	-50
	5	420	730	40	160	1,350	330
	6	0	0	0	200	200	1,190
	7	0	0	0	200	200	1,870
	8	0	0	0	200	200	2,410
	9	0	0	0	200	200	2,840
	10	0	0	0	200	200	3,150
	11	0	0	0	200	200	3,310
	12	0	0	0	200	200	3,520
	13	0	0	0	200	200	3,590
	14	0	0	0	200	200	3,620
	15	0	0	0	200	200	3,640
	16-30	0	0	0	200	200	3,670

Economic Rate of Return: 20%

Total Project Economic Rate of Return: 20%

1/ Rounded to nearest US$10,000.
2/ Incremental gross value of production from Annex 7, Table 2 @ F$25/ton minus incremental farm operating costs from Annex 7, Table 6 minus incremental farm labor cost except for harvesting. Includes US$500,000 in year five for the residual value of road construction equipment.
3/ Excludes taxes and includes engineering, supervision and administration.
4/ The cost of maintaining farm access roads plus half the cost of maintaining the main road.
5/ Incremental gross value of production from Annex 8, Table 3 @ F$25/ton minus incremental farm operating costs from Annex 8, Table 8 minus incremental farm labor cost except for harvesting.
6/ F$6/ac for O&M of seawalls and common user drains plus the imputed cost of maintaining on-farm drains.
7/ Includes mapping, offices and vehicles.

ANNEX 10
Table 4

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SUGAR DEVELOPMENT PROJECT

Sensitivity Analysis

	Economic Rate of Return (%)
Seaqaqa Settlement	
1. Benefits decreased by 25%	15
2. Benefits delayed by two years	15
3. Construction costs increased by 20%	17
4. Combination of (2) and (3)	13
5. Including the full costs of main road improvements, tramline extension and township development	12
6. Official exchange rate	17
7. All incremental farm labor valued at peak season wage of F$6/man-day.	19
8. Combination of (6) and (7)	16
Drainage Improvement	
1. Benefits decreased by 25%	16
2. Benefits delayed by two years	16
3. Construction costs increased by 20%	18
4. Combination of (2) and (3)	15
5. Official exchange rate	17
6. All incremental farm labor valued at peak season wage of F$6/man-day	18
7. Combination of (5) and (6)	15

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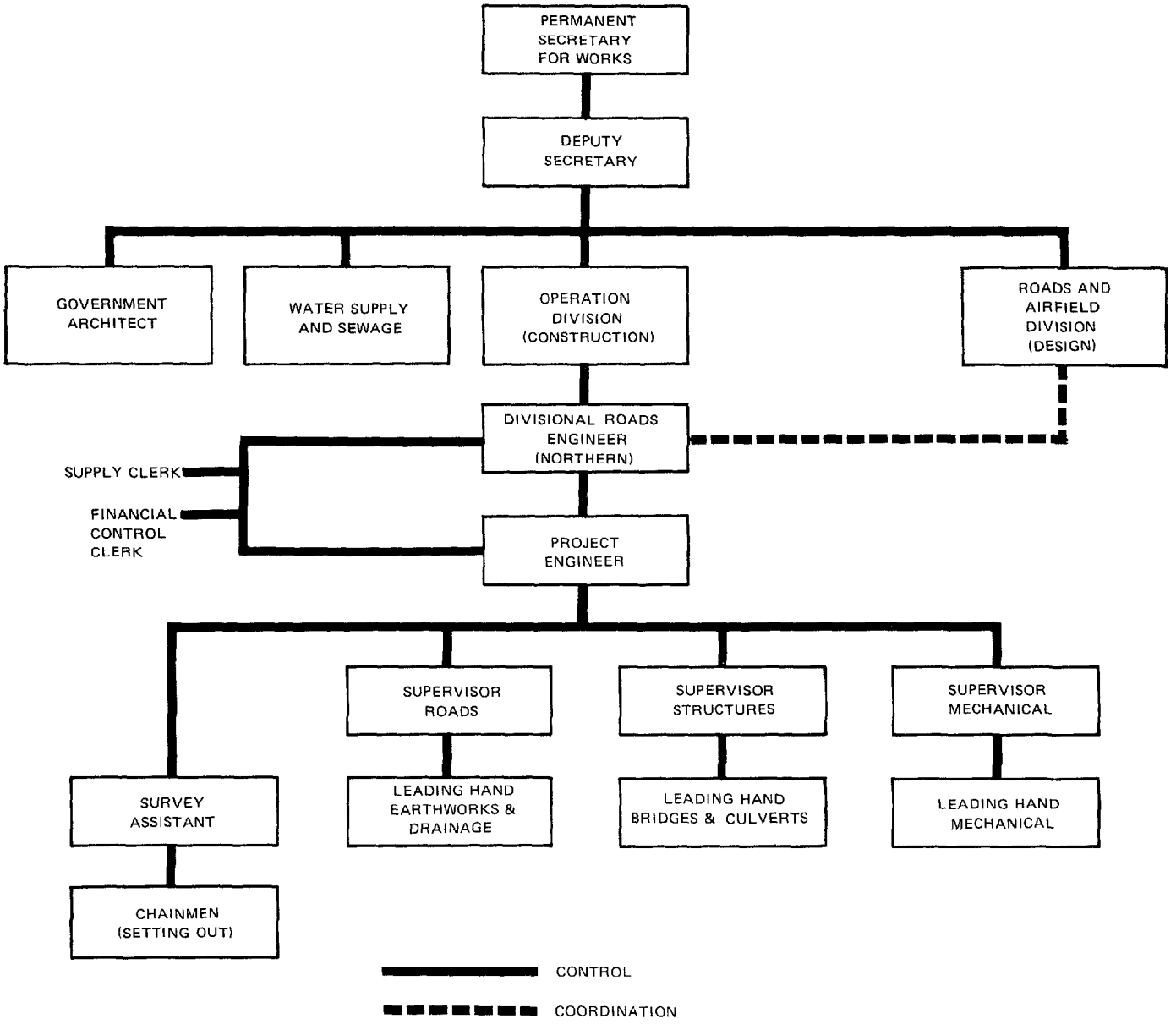
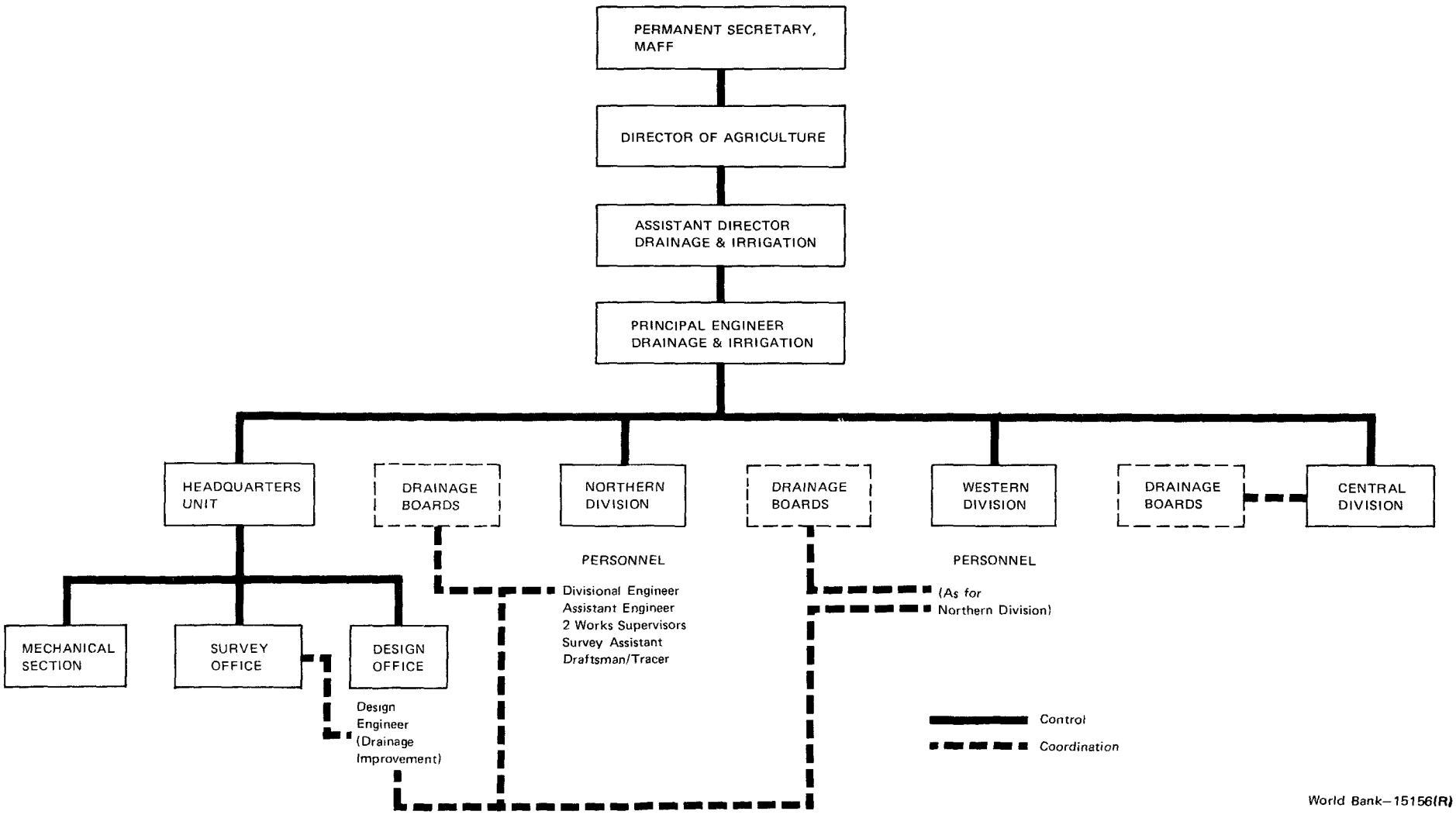
SUGAR DEVELOPMENT PROJECT
SEAQAQA SETTLEMENT
Organization for Road Construction



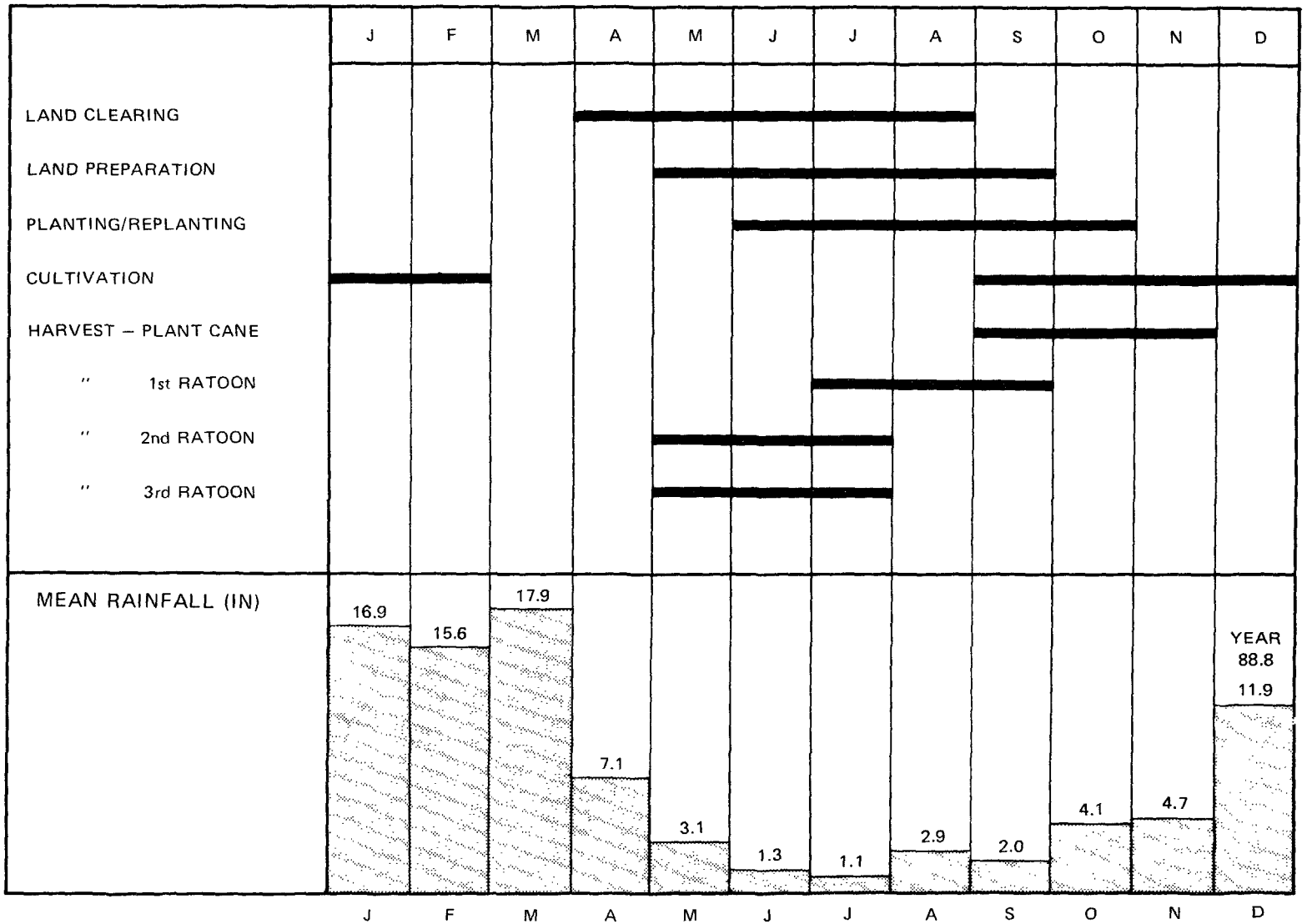
World Bank–15155(3R)

FIJI
SUGAR DEVELOPMENT PROJECT
DRAINAGE IMPROVEMENT
Organization for Drainage & Irrigation Division



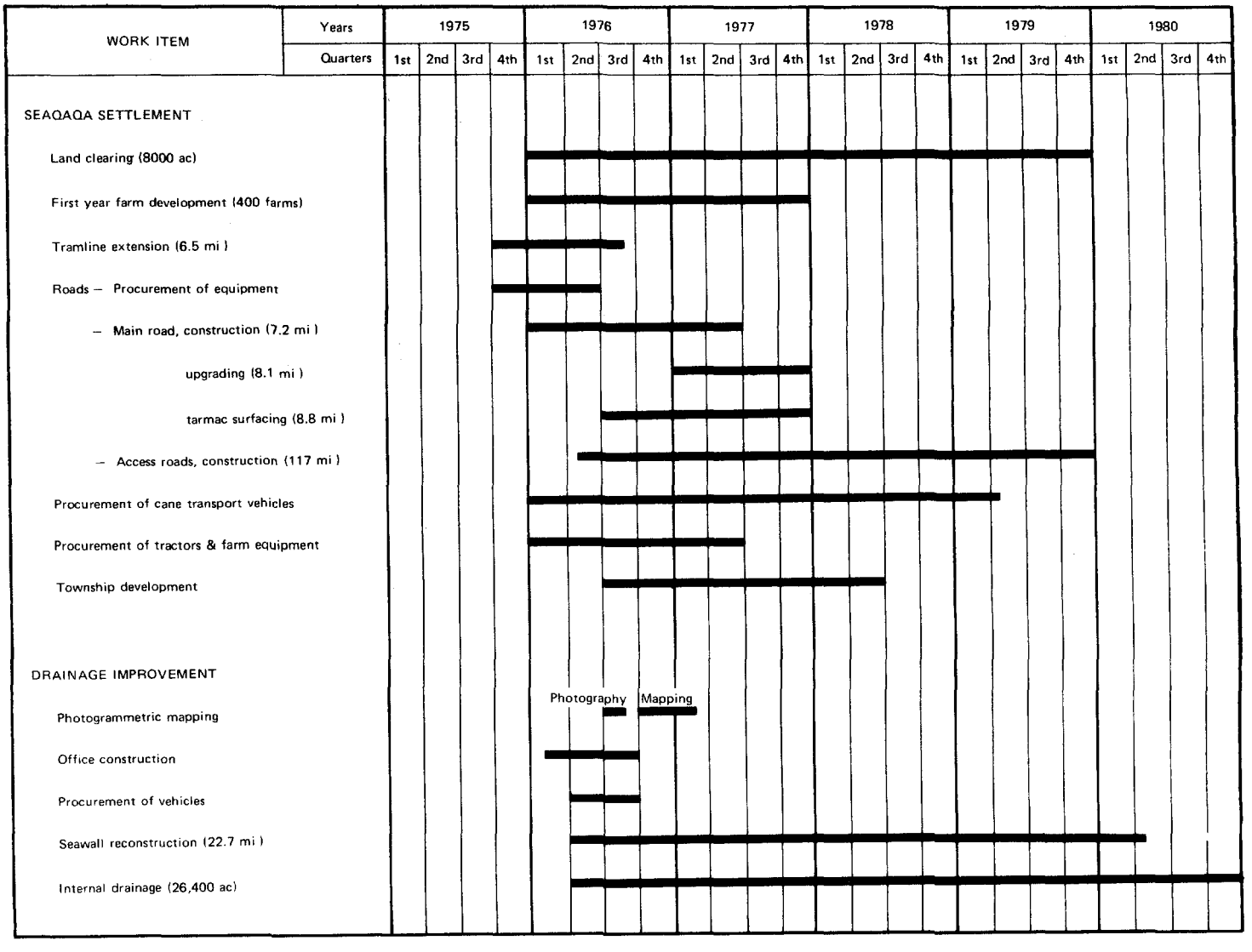
World Bank–15156(R)

FIJI
SUGAR DEVELOPMENT PROJECT
SEAQAQA SETTLEMENT
Calendar of Farm Operations



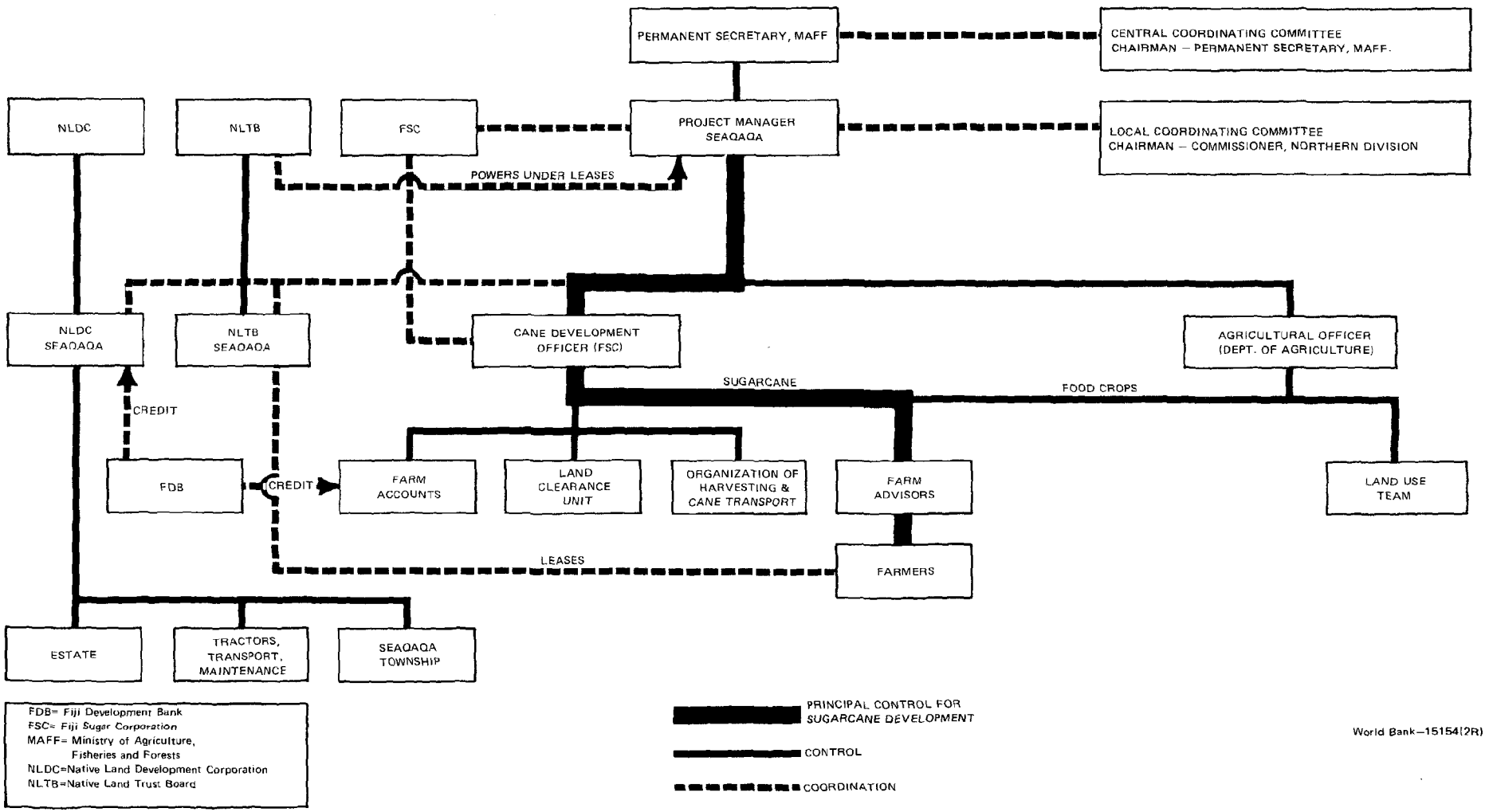
World Bank–15157(2R)

FIJI
SUGAR DEVELOPMENT PROJECT
IMPLEMENTATION SCHEDULE



World Bank–15164

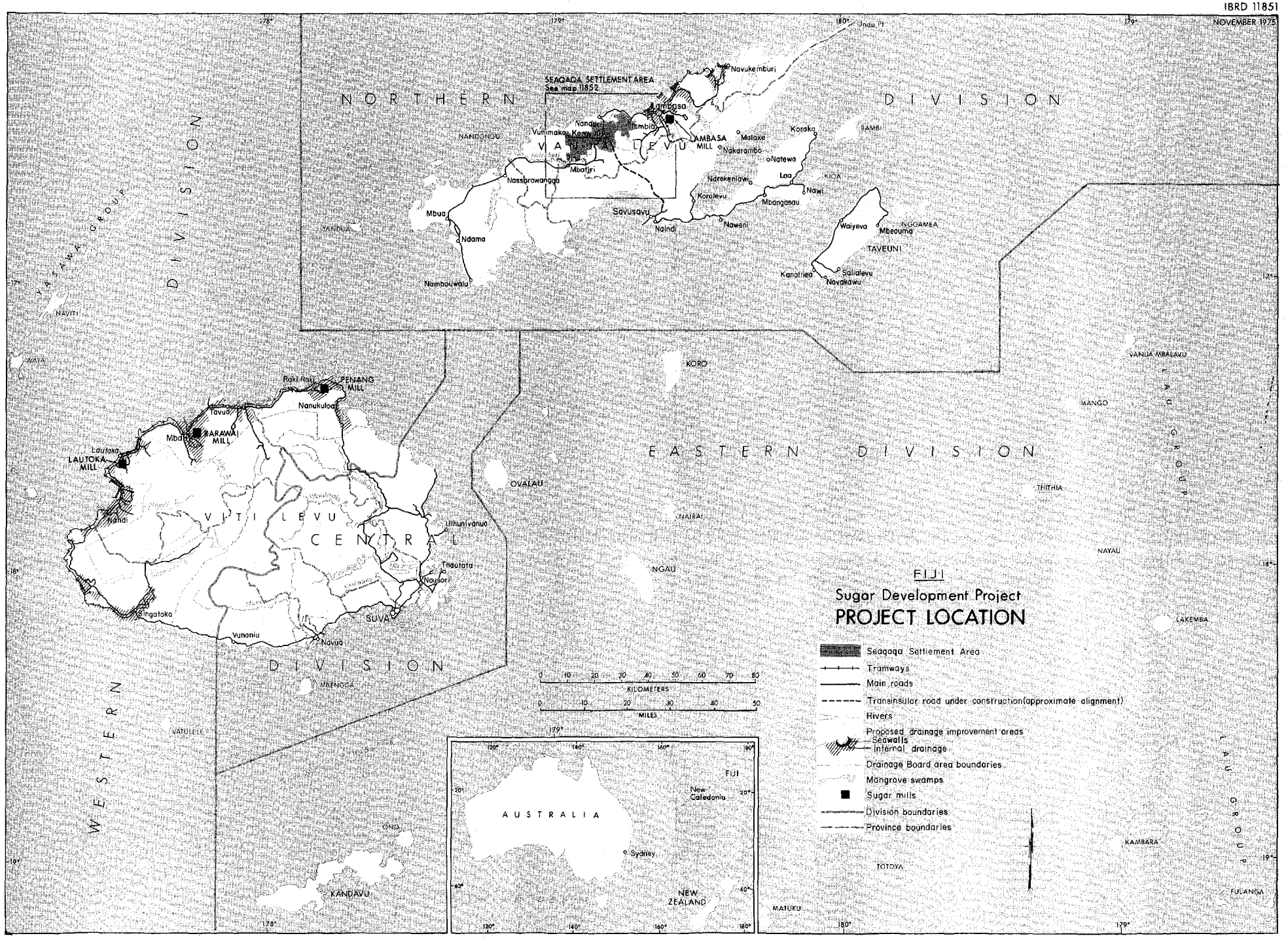
FIJI
SUGAR DEVELOPMENT PROJECT
SEAQAQA SETTLEMENT
Management Organization



World Bank–15154(2R)

IBRD 11851

NOVEMBER 1975



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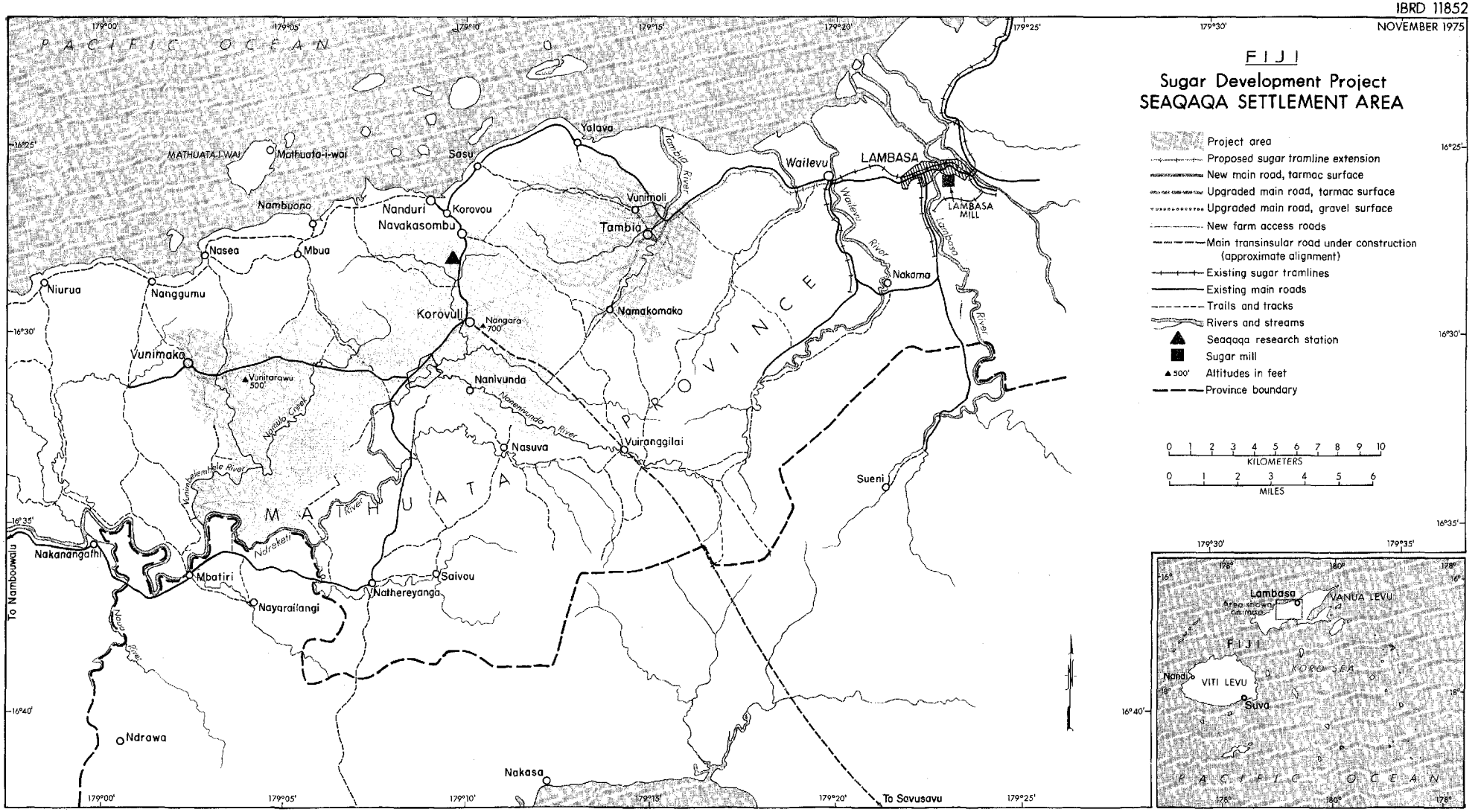

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Sugar Development Project
SEAQAQA SETTLEMENT AREA

- Project area
- Proposed sugar tramline extension
- New main road, tarmac surface
- Upgraded main road, tarmac surface
- Upgraded main road, gravel surface
- New farm access roads
- Main transinsular road under construction (approximate alignment)
- Existing sugar tramlines
- Existing main roads
- Trails and tracks
- Rivers and streams
- Seaqaqa research station
- Sugar mill
- ▲500' Altitudes in feet
- Province boundary

0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

0 1 2 3 4 5 6 MILES